The New Brunswick
Electric Power Commission

Health Physics Department

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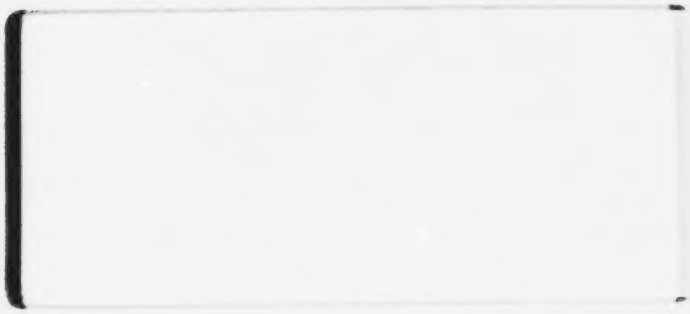

ENVIRONMENTAL RADIATION
MONITORING DATA
FOR
POINT LEPREAU GENERATING STATION
January 01, 1985 to December 31, 1985

Prepared by:
J. K. Sutherland.

Reviewed by:
J. J. Paciga.

Approved by:
J. U. Burnham.

Health Physics Department
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SUMMARY

This report, issued annually, is a compilation of the 1985 radiation data collected in the NBEPC Environmental Monitoring Program around the Point Lepreau Generating Station (PLGS).

In 1985 over 2000 analyses were made on 1200 samples. The various sample types collected and analysed cover all of the major pathways of radiation emissions to the local population.
The major sample types are listed below.

Airborne Particulates	207 samples
Airborne Radioiodines	208 "
Airborne Tritium	104 "
Milk	20 "
Sea Water	17 "
Well Water	18 "
Clams	13 "
Fish	13 "
Lobster	8 "
Dulse	9 "
Periwinkles	4 "
Crabs	2 "
Scallops	8 "
Inter-tidal Sediment	41 "
Thermoluminescent dosimetry and Beach Surveys	159 "

All sample types contain detectable levels of natural radioactivity. With one exception, airborne water vapour, no sample type contained any detectable radionuclide emitted from PLGS.
All radionuclides, other than tritium, emitted from the station and detected by the Station Effluent Monitoring Program, are so diluted by dispersal in the atmosphere and in seawater that they are not detectable in this monitoring program. Beach Surveys and the measurement of ambient radiation levels by thermoluminescent dosimetry have not detected any change in radiation levels in the area as a result of the operation of PLGS.
Tritium, as tritiated water vapour in air, is the only radionuclide from PLGS that is detected outside of the exclusion zone boundary.
The only measurable radiation dose from PLGS on the local population is that from tritiated water vapour in air and is about 0.3 microsievert per annum at the exclusion zone boundary. Natural radiation in the area contributes more than 5000 times this level.

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A. R. McKenzie - Station Manager, PLGS, NBEPC.
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J. J. Paciga - Station Health Physicist, PLGS.
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Health and Welfare Canada,
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K1A 1C1.

D. J. Gorman - Ontario Hydro,
Central Safety Services,
Pickering G.S.,
P.O. Box 160, Pickering,
Ontario. L1V 2R5.

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ENVIRONMENTAL REPORTS OF PREVIOUS YEARS

PRE-OPERATIONAL (1975 - 1982)

1 Pre-Operational Radiological Environmental Monitoring Program for Point Lepreau Nuclear Generating Station. NBEPC-HP-75-1. J. A. Flanigan. 1975.

2 Pre-Operational Environmental Radiation Monitoring Data for Point Lepreau Generating Station. October 1, 1976 to June 30, 1979. NBEPC-HP-79-1. J. A. Flanigan and J. J. Paciga. Sept. 1979.

3 Pre-Operational Environmental Radiation Monitoring Data for Point Lepreau Generating Station. January 1, 1979 to December 31, 1979. NBEPC-HP-80-1. J. A. Flanigan. Sept. 1980.

4 Pre-Operational Environmental Radiation Monitoring Data for Point Lepreau Generating Station. January 1, 1980 to December 31, 1980. NBEPC-HP-81-1. J. K. Sutherland and J. A. Flanigan. July 1981.

5 Pre-Operational Environmental Radiation Monitoring Data for Point Lepreau Generating Station. January 1, 1981 to December 31, 1981. NBEPC-HP-82-1. J. K. Sutherland. February 1982.

OPERATIONAL (1982 - 1984)

6 Operational Environmental Radiation Monitoring Program. Revision 1, January 1982. RD-01364-L15. J. K. Sutherland.

7 Environmental Radiation Monitoring Data for Point Lepreau Generating Station. January 01, 1982 to December 31, 1982. HP-07000-83-1. J. K. Sutherland. March 1983.

8 Environmental Radiation Monitoring Data for Point Lepreau Generating Station. January 01, 1983 to December 31, 1983. HP-07000-84-1. J. K. Sutherland. February 1984.

9 Environmental Radiation Monitoring Data for Point Lepreau Generating Station. January 01, 1984 to December 31, 1984. HP-07000-85-1. J. K. Sutherland. February 1985.

1.0 INTRODUCTION

The data contained in this report were collected over the period from January 1st 1985 to December 31st 1985. During this time, the sample types and frequency of collection were approximately as indicated in Table 1.2. The collection frequency is dictated by the level of radionuclide emissions as indicated in the table.

All analyses (approximately 2000 measurements) were performed in the Health Physics Environmental Laboratory at 420 York Street, Fredericton, N.B.

Quality Assurance (QA) intercomparison data for the same period are included as they indicate the level of competence of the laboratory to make the various determinations. Although participation in the QA program is at a specified level, samples may not always be provided as scheduled, or results from the QA agent may arrive too late for incorporation into this report.

The Point Lepreau Generating Station (PLGS) was declared in Commercial Operation on January 31st 1983. The Gross Capacity Factors, indicating the level of operation over the last three years, are tabulated below:

TABLE 1.1

PLGS PRODUCTION PERFORMANCE

	1983 %	1984 %	1985 %
Gross Capacity Factor	85.69	89.74	97.38

Even though the power generation was maintained at a high production level in 1985, environmental samples have generally not shown the presence of any radionuclide, other than tritium, attributable to the operation of PLGS.

A new section (6.0) was added to the report this year. It tabulates the data on the source emissions from PLGS in the air and liquid effluent pathways, since the In-Service date of January 31st 1983.

The only off-site environmental samples which contained radionuclides emitted from PLGS in 1985 are airborne water vapour samples taken in the immediate vicinity of PLGS.

Those airborne water vapour samples, taken on-site, from within 1 km of the stack and from the SRWMF, generally contain tritium levels above the analytical detection limit. Outside of the 1 km boundary, the levels of tritium in air are usually not detectable or are just above the detection threshold. Since this detection threshold approaches approximately 0.001% of the general public DAC*, the levels of tritium in the environment from the operation of PLGS are insignificant for 1985.

Parshall Flume and Bore Hole water samples from the Solid Radioactive Waste Management Facility (SRWMF), and Lagoon water samples from the PLGS site indicated evidence of contamination. All but one of the lagoon water samples contained tritiated water.

Emissions from PLGS are closely monitored at the source in both the Gaseous Effluent Monitoring (GEM) and Liquid Effluent Monitoring (LEM) programs. Samples from these programs are also screened in the Environmental Monitoring Program to signal radionuclides which might subsequently appear in the environment. They are also analysed in the Fredericton laboratory to determine strontium-90 levels.
If radiostrontium is not detectable or occurs at insignificant levels in these GEM or LEM samples, then radiostrontium analyses are usually not done on other samples in the environmental program because of the large effect of atmospheric dispersion and dilution. Because of the low levels of Sr-90 emissions throughout the year, as indicated by the analyses of the GEM and LEM samples, no off-site environmental samples were analysed for Sr-90 in 1985.

* The DAC (Derived Air Concentration) for each radionuclide is the calculated activity in each cubic metre of air that, if maintained for one year, will expose a member of the Critical Group (i.e., the most exposed members of the public) to the Dose Limits for the general public.

TABLE 1.2

SCHEDULE OF SAMPLE COLLECTION AND ANALYSIS

SAMPLE TYPE OR SURVEY	LEVEL I FREQUENCY <1% DEL (1)	LEVEL II FREQUENCY 1-10% DEL	LEVEL III FREQUENCY +10% DEL
Air Particulate (2)	Bi-weekly	Weekly	Weekly
Air Iodine (2)	Bi-weekly	Weekly	Weekly
Air Tritium (2)	Monthly	Weekly	Weekly
TLD (2)	Quarterly	Monthly	Monthly
Sediment	Quarterly	Monthly	Monthly
Beach Survey	Quarterly	Monthly	Weekly
Ground Water (Well, Surface)	Semi-annually	Quarterly	Monthly
Sea Water	Quarterly	Monthly	Monthly
Milk	Quarterly (3) Monthly (4)	Monthly	Monthly
Seafood (Clams, Scallops, Dulse, Crabs, Lobster, Fish, Periwinkles)	Semi-annually	Monthly	Weekly
	---------- As available ----------		

(1) DEL means Derived Emission Limit.
(2) Integrated sample.
(3) Quarterly from selected dairy herds in southern N.B.
(4) Commercial dairy milk sample.

The numbers of environmental samples processed in each category over the last six years are as shown below:

TABLE 1.3

SAMPLE INFORMATION

Sample Type	Number of Samples Analysed. Year					
	1980	1981	1982	1983	1984	1985
AC Air C-14	--	--	2	11	13	28
AI Air Iodine	56	55	260	363	208	208
AP Air Particulate	55	55	260	363	208	207
AT Air Tritium	56	52	72	94	101	104
BH Bore Hole (SRWMF)	--	3	10	30	24	15
CL Clams	10	9	6	7	12	13
CR Crabs	--	--	--	--	1	2
DU Dulse	2	1	1	7	7	9
FI Fish	4	9	21	14	16	13
LO Lobster	4	3	5	5	7	8
LW Lagoon Water	--	--	--	2	22	33
MI Milk	15	62	19	20	19	20
PE Periwinkles	--	--	--	--	3	4
PF Parshall Flume	--	--	10	44	47	67
QA Quality Assurance	33	21	21	21	24	30
SC Scallops	--	--	--	3	7	8
SE Sediment	40	40	40	40	41	41
SO Soil	--	--	2	--	--	4
SP Sea Plant	--	--	--	--	4	8
SW Sea Water	16	16	16	17	18	17
VG Vegetation (Lichen)	--	4	2	13	13	13
WW Well Water	18	18	18	18	18	18
ZZ Miscellaneous	1	--	6	6	11	77
TLD	87	112	95	115	120	119
BS Beach Surveys	33	39	40	40	40	40

Two seafood types added in 1984 were periwinkles and crabs. Approximately 45 metric tons of periwinkles were collected on a commercial basis from the Lepreau area in 1984. 'Jonah' crabs are found in the cooling water outflow from PLGS and are fished intermittently.

Numerous other low-activity samples, not indicated above, are processed in the Fredericton laboratory each year. These samples originate at PLGS. They are analysed in the environmental laboratory because of the lower detection limits of the laboratory equipment or require special techniques developed in the laboratory as, for example, with the radiostrontium analyses.

Other programs in place to monitor environmental samples from the Point Lepreau area are conducted by:

1. The Department of Health in New Brunswick.
2. The Bedford Institute of Oceanography (BIO), in Dartmouth, Nova Scotia.
3. The Federal Department of Health and Welfare in Ottawa.

Where the same types of sample are collected from the Point Lepreau area by the various agencies the results, where available, are comparable. Differences arise where the sample collection intervals are not the same. For example some of the BIO air monitoring facilities in the area are operated one week in four as compared with continuous operation of the NBEPC locations.

2.0 SAMPLE LOCATIONS

The sample locations are shown in Figures 2.1 to 2.5. Each 'Indicator' station has a three-character identification code (e.g., F01). An indicator station is one within the possible influence of PLGS emissions. 'Reference' locations, chosen to lie outside the influence of PLGS operations, are identified by the letter R at the end of the location code (e.g., A01R).

Sampling locations for mobile seafood species (lobster, fish, etc.) caught in the Point Lepreau area are not specified except for the 'Jonah' crabs which are caught near the PLGS cooling water outflow. With the exception of Reference location samples, all samples analysed are either purchased from local fishermen who made their catch in the Point Lepreau area or are collected by laboratory staff.

On-site samples from the Solid Radioactive Waste Management Facility (SRWMF) are analysed on a regular basis. These include Parshall Flume, Bore Hole and, where available, cell drainage samples. Added in 1984, were samples from the lagoons on the PLGS site. These lagoons accept drainage from areas which usually are non-active.

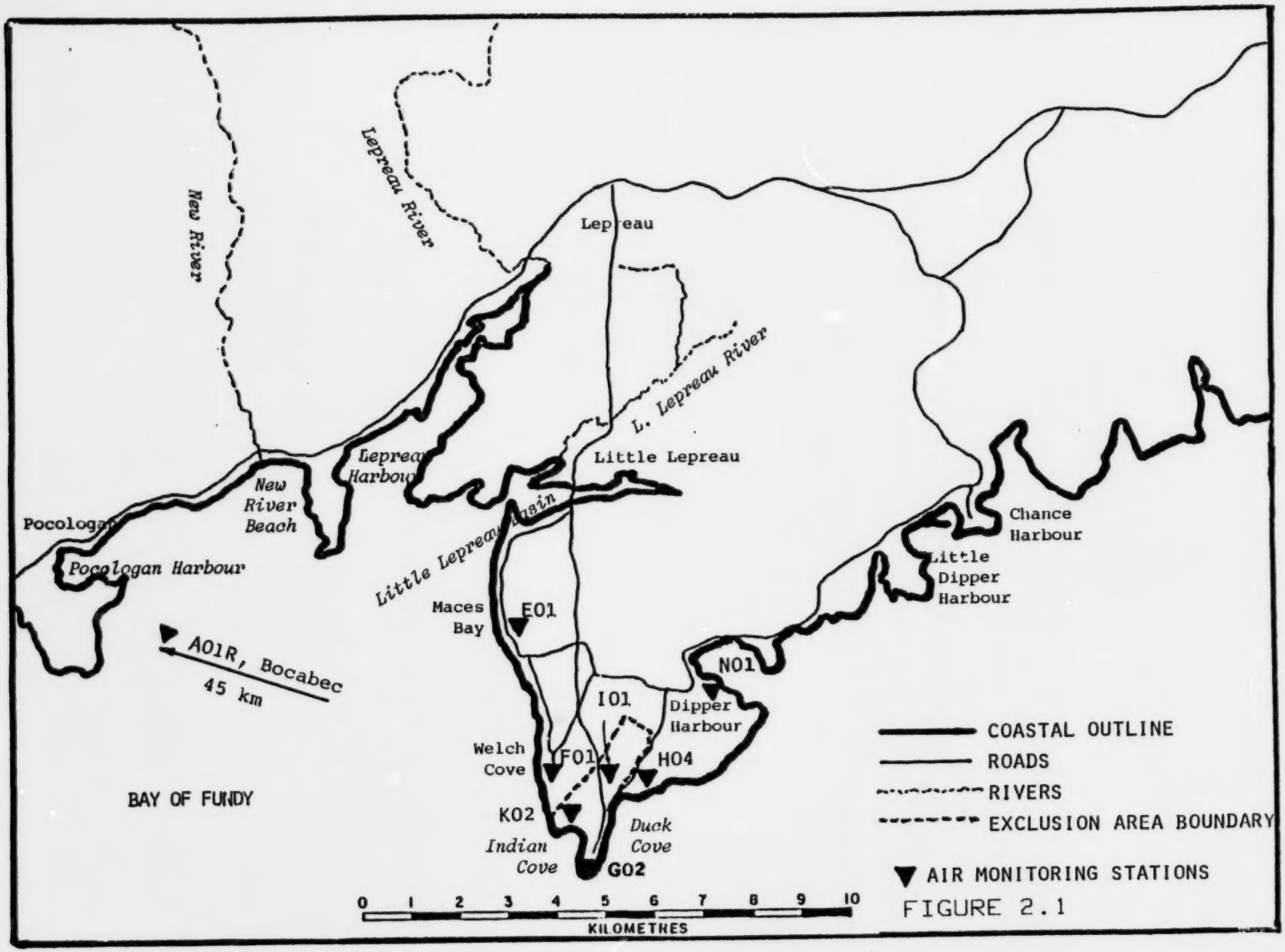

New River
Lepreau River
Lepreau
L. Lepreau River
Little Lepreau
Lepreau Harbour
New River Beach
Pocologan
Pocologan Harbour
Little Lepreau Basin
Maces Bay
E01
A01R, Bocabec
45 km
BAY OF FUNDY
Welch Cove
F01
I01
H04
K02
Indian Cove
Duck Cove
G02
Dipper Harbour
N01
Little Dipper Harbour
Chance Harbour
0 1 2 3 4 5 6 7 8 9 10
KILOMETRES
COASTAL OUTLINE
ROADS
RIVERS
EXCLUSION AREA BOUNDARY
AIR MONITORING STATIONS

FIGURE 2.1

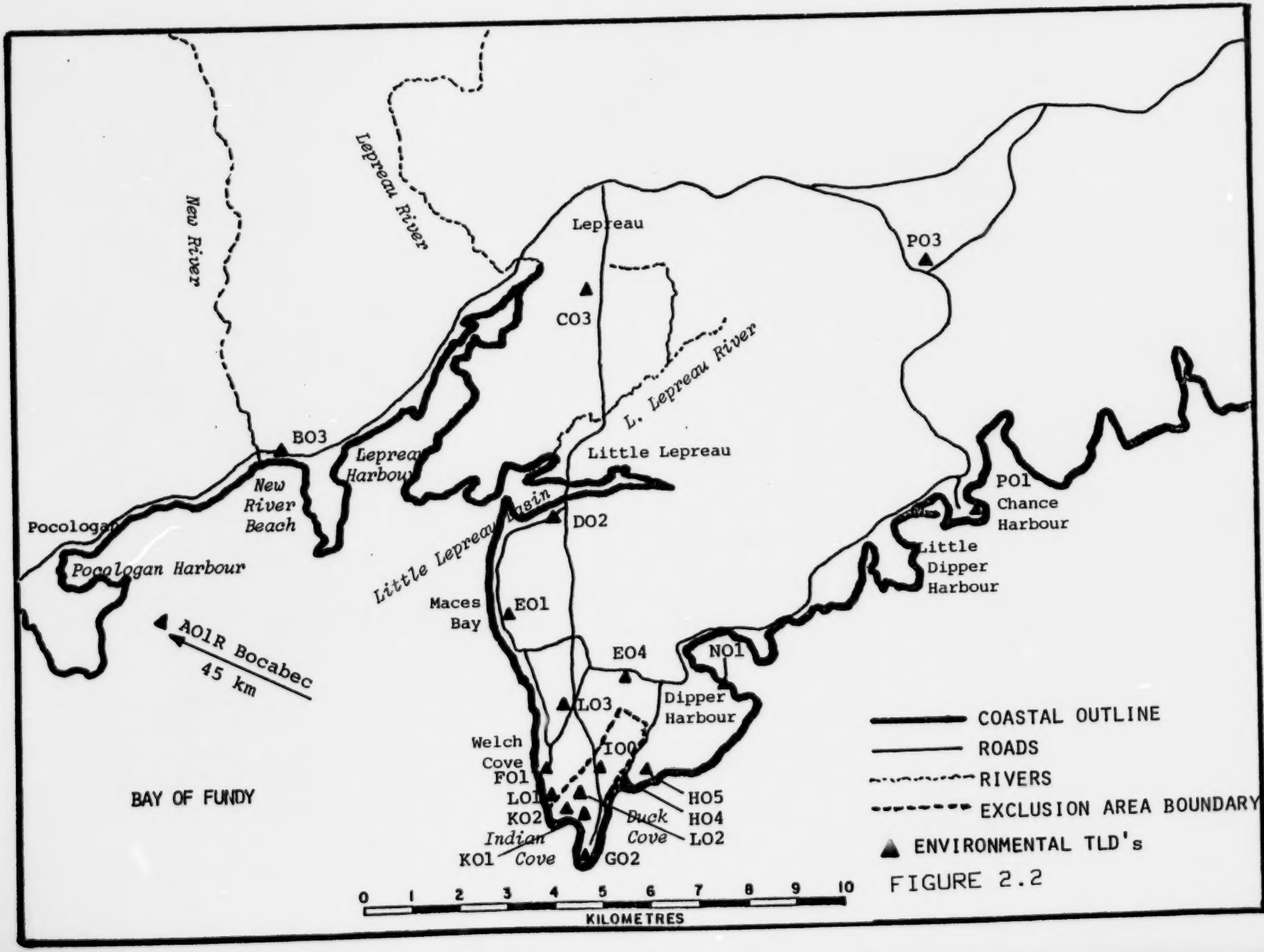

New River
Lepreau River
Lepreau
PO3
CO3
L. Lepreau River
BO3
Lepreau Harbour
Little Lepreau
New River Beach
Pocologan
Pocologan Harbour
Little Lepreau Basin
DO2
PO1
Chance Harbour
Little Dipper Harbour
Maces Bay
EO1
AO1R Bocabec
45 km
EO4
NO1
LO3
Dipper Harbour
Welch Cove
IO0
FO1
LO1
KO2
HO5
HO4
LO2
Duck Cove
Indian Cove
KO1
GO2
BAY OF FUNDY
0 1 2 3 4 5 6 7 8 9 10
KILOMETRES
COASTAL OUTLINE
ROADS
RIVERS
EXCLUSION AREA BOUNDARY
ENVIRONMENTAL TLD's

FIGURE 2.2

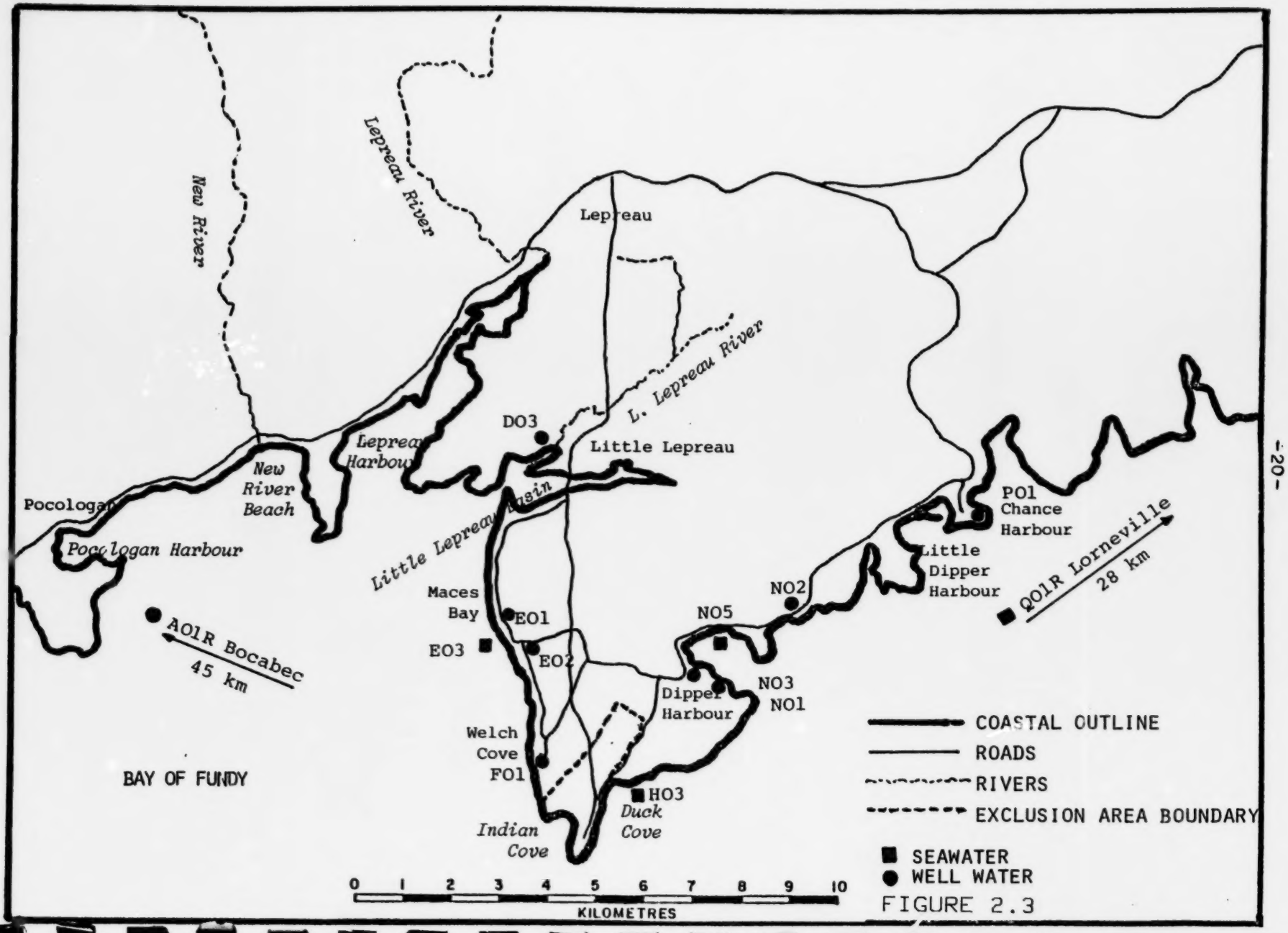

New River
Lepreau River
Lepreau
L. Lepreau River
DO3
Little Lepreau
Lepreau Harbour
New River Beach
Pocologan
Pocologan Harbour
Little Lepreau Basin
Maces Bay
EO1
EO3
EO2
AO1R Bocabec
45 km
BAY OF FUNDY
Welch Cove
FO1
Indian Cove
HO3
Duck Cove
Dipper Harbour
NO3
NO1
NO5
NO2
Little Dipper Harbour
PO1
Chance Harbour
QO1R Lorneville
28 km
COASTAL OUTLINE
ROADS
RIVERS
EXCLUSION AREA BOUNDARY
SEAWATER
WELL WATER
0 1 2 3 4 5 6 7 8 9 10
KILOMETRES

FIGURE 2.3

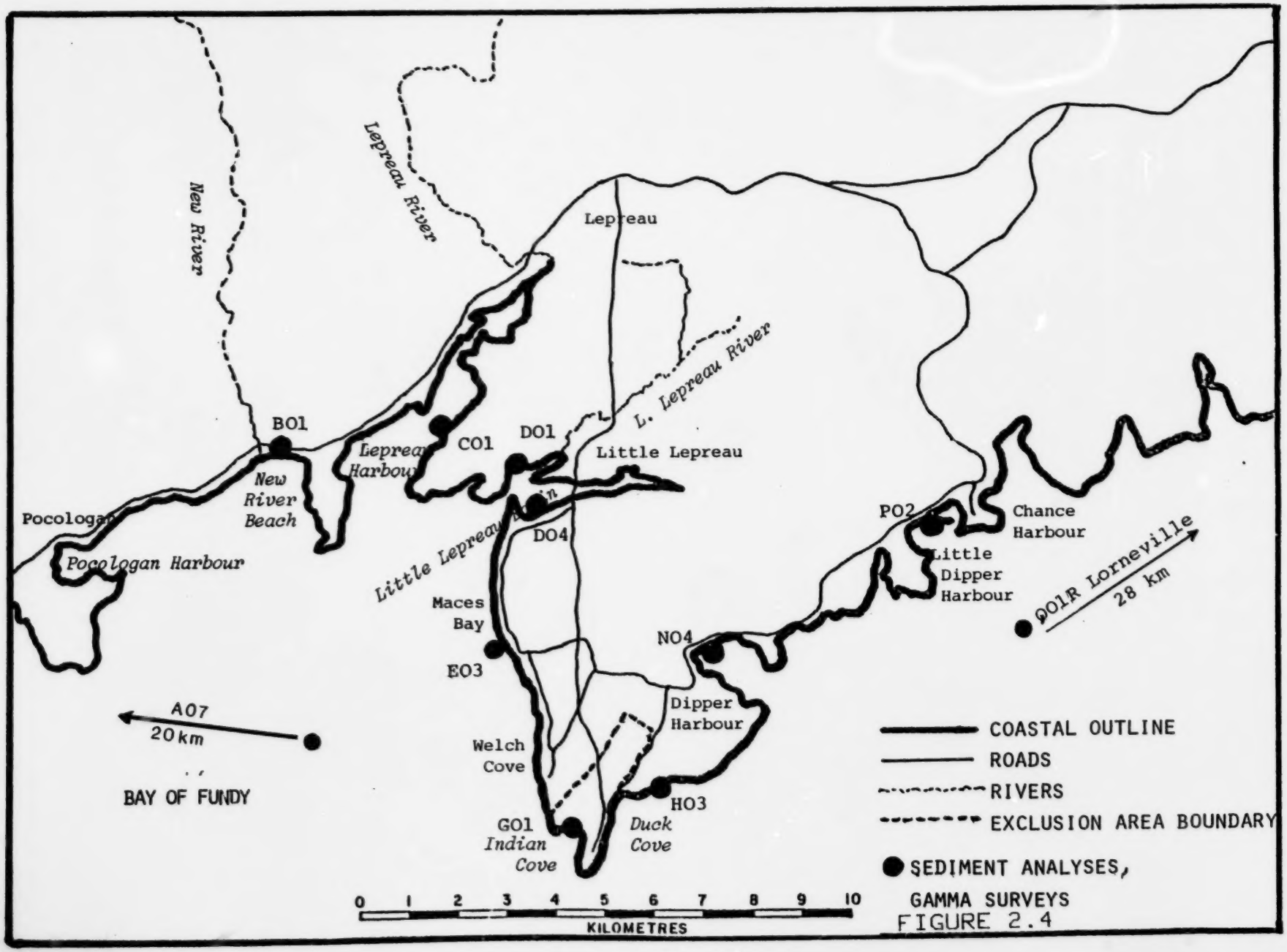
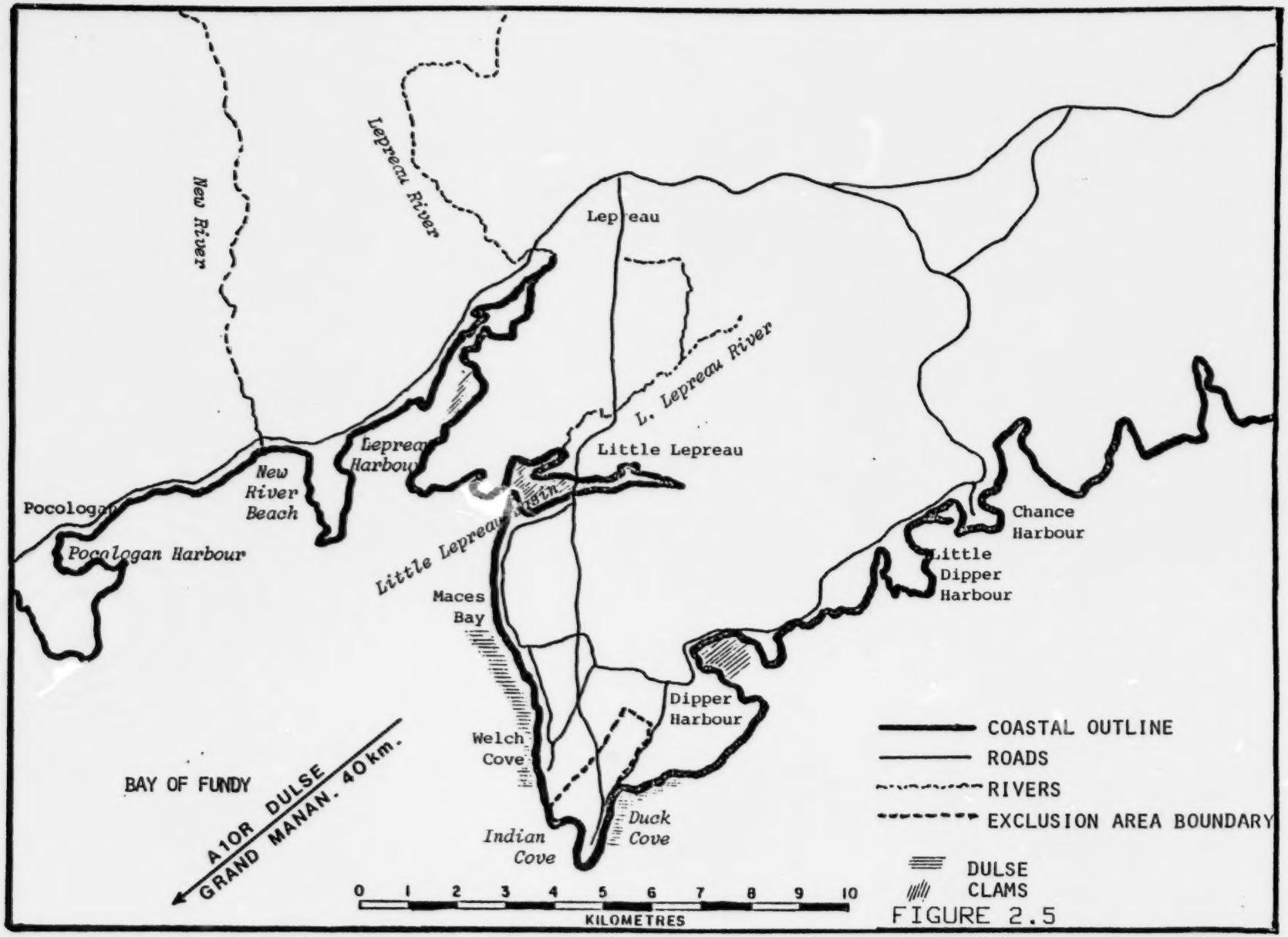

New River
Lepreau River
Lepreau
L. Lepreau River
BO1
CO1
DO1
Little Lepreau
New River Beach
Pocologan
Pocologan Harbour
Little Lepreau
DO4
Maces Bay
EO3
NO4
PO2
Chance Harbour
Little Dipper Harbour
QO1R Lorneville
28 km
A07
20 km
BAY OF FUNDY
Dipper Harbour
Welch Cove
HO3
GO1
Indian Cove
Duck Cove
COASTAL OUTLINE
ROADS
RIVERS
EXCLUSION AREA BOUNDARY
SEDIMENT ANALYSES, GAMMA SURVEYS
0 1 2 3 4 5 6 7 8 9 10
KILOMETRES

FIGURE 2.4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Little Lepreau
Maces Bay
Welch Cove
Indian Cove
Duck Cove
Dipper Harbour
Chance Harbour
Little Dipper Harbour
BAY OF FUNDY
A1OR DULSE
GRAND MANAN. 40km.
0 1 2 3 4 5 6 7 8 9 10
KILOMETRES
COASTAL OUTLINE
ROADS
RIVERS
EXCLUSION AREA BOUNDARY
DULSE
CLAMS

FIGURE 2.5

3.0 STATISTICS, ANALYTICAL TECHNIQUES, SAMPLE COLLECTION

3.1 Introduction

This section provides a summary of the analytical techniques used in the Health Physics Environmental Laboratory. Statistics, sample collection, preparation and analysis are briefly described.

3.2 Statistics

The following statistical conventions are applied in the analysis of each sample:

1) Detection limits are defined following the method described by Lochamy (NBS Special Publication 456 - Measurements for the Safe Use of Radiation, U.S. Department of Commerce, 1976). The Lower Limit of Detection (LLD) at the 99% confidence level is defined as 6.58 Sb, where Sb is the standard deviation of the appropriate, ill-defined, background measurement. Such an ill-defined background is typical of the germanium detector analyses, liquid scintillation analyses and alpha/beta determinations. This LLD corresponds to that amount of activity in a sample that will yield a net count greater than 3.29 Sb, i.e., the so-called Critical Level (CL), with 99% probability. The LLD specifies the theoretical capability of the system to quantify a given amount of radioactivity, whereas the CL is used to determine in practice whether a single activity measurement should be considered "detected". Any individual measurement greater than 3.29 Sb is considered detected at the 99% confidence level. This also implies a 1% probability of stating that activity is present when it is not (false positive). If activity is present at the LLD level (6.58 Sb) there is a 1% probability of stating that activity is not present when it is (false negative).
In most of the tables of data (Section 4.0), it is this Critical Level that appears in column 1.
Where there are sufficient background data to provide a well defined background as for example with the TLD data, the CL is defined as 2.33 Sb and the LLD as 4.66 Sb.

2) Unless otherwise indicated, the precision of the measurements reported here is given as +- 1.96 Sa (95% confidence level), where Sa is the standard deviation of the activity measurement.

3) The value and standard deviation are reported with two significant figures using modified scientific notation, for example 0.032 is expressed as 3.2E-02.

3.3 Analytical Techniques

The major analytical techniques and the instruments used in routine environmental analysis are summarized in Table 3.1. In the case of gamma spectrometry analysis, all significant peaks in the spectrum are identified either by reference to a library of about 100 radionuclides in a computer library, or by manual reference to compilations of all known radionuclides. In addition, approximately 20 'selected' radionuclides are specifically searched for in every sample with the exception of Air Iodine samples in which only I-131 is 'selected'. The 'selected' radionuclides are those which are produced in PLGS and which would be readily detectable because of their abundance (high fission yield) and high branching ratios for gamma emissions. Naturally occurring gamma emitters - daughter radionuclides of uranium and thorium; cosmogenic radionuclides and any of the 18 or so known radioactive species found in nature - are present in most samples, but with the exception of Be-7, K-40 and Ac-228 are not included in this report. The latter nuclides are sometimes useful as general indicators of the consistency of the analytical techniques and are thus reported.

The usefulness of alpha/beta analysis lies primarily in screening samples to determine whether more detailed analyses should be performed. The reported alpha-beta values are assessed using Am-241 and Sr-Y-90 calibration sources respectively.

Wet chemical analyses for Sr-90 on gaseous effluent (GEM) and liquid effluent (LEM) samples covering the entire year are included in the environmental monitoring program. The technique involves chemical separation of strontium from the associated impurities, precipitation, filtration and repeated analysis from 1 to about 14 days after the separation. Analysis of these PLGS source samples provides sufficient information on emissions of Sr-90 (and of Sr-89 if the count rates allow it) to indicate whether it is worthwhile analysing the 200 or more air particulate samples for this radionuclide. Emissions of Sr-90 and Sr-89 in 1985, have been so low that the large atmospheric dispersion and dilution effects cause activity levels in the environment to be well below the detection limit of the analytical method.

TABLE 3.1

SUMMARY OF ANALYTICAL TECHNIQUES

Analytical technique	Instrumentation
Gamma Spectroscopy	A Canberra 24% efficient intrinsic germanium detector, in an Applied Physical Technology 10 cm graded lead cave. A NaI (7.6x7.6 cm) detector in an APT 10 cm graded lead cave. Ortec Model 7010 multichannel analyser (4096 channels). Hewlett-Packard 9845B microcomputer for automatic data reduction (20 megabyte hard disc storage capacity).
Liquid Scintillation (Tritium and C-14)	Beckman LS-100C counter
Gross Alpha/Beta and Sr-90 Analyses	Tennelec LB-5100 alpha/beta detector.
Thermoluminescent Dosimetry	Panasonic UD-710A Automatic TLD Reader and UD-814AC dosimeters.
Chemical analysis, Ion exchange separation	Laboratory separation and analysis for Sr-90 on various sample types. The final analysis is by Tennelec alpha/beta counting.

3.4 Sample Collection, Analysis and Detection Limits

3.4.1 Airborne Particulates

Collection

Airborne particulates are collected on a 47 mm diameter Gelman Type A glass fibre filter through which air is drawn at 60 L/min (approximately 1200 m3 for a 14 day continuous sample). The volume of air sampled is measured with an in-line integrating dry gas meter.
Every two weeks the filters are replaced and the used ones returned to the laboratory for analysis. Sampling is therefore continuous throughout the year, the only interruption, other than because of power failure or pump breakdown, being the five minute filter change.

Analysis and Detection Limits

Air particulate filters are analysed by gamma spectrometry as soon as possible after collection to ensure detection of any short lived gamma emitters that may be present, and to minimise any decay corrections. Samples are counted for 5000 s on a 24%-efficient intrinsic germanium gamma spectrometer. Typical LLDs are given in Table 3.2 for a 1200 m3 sample. The LLDs are decay corrected to the time of sample collection. Throughout this section and in the data tables the radionuclides are listed in order of increasing 'selected' photon energy (exceptions to this are the additional data for gross alpha, gross beta and tritium).
Approximately three days after the end of the sample collection, each filter is counted for 100 minutes for the simultaneous determination of gross alpha and gross beta activity. Counting is delayed for this length of time to allow for the decay of activity of the short-lived naturally occurring radon daughters which are present in all of these samples and which would otherwise complicate the analysis.

TABLE 3.2

LLD ON AIR PARTICULATE SAMPLES

Nuclide	LLD (Bq/m3)
Gross alpha	4E-05
Gross beta	8E-05
Ce-144	1E-03
Ce-141	4E-04
Cr-51	2E-03
I-131	4E-04
Be-7	4E-03
Ru-103	2E-04
Ba-140	1E-03
Cs-134	2E-04
Ru-106	2E-03
Cs-137	2E-04
Zr-95	4E-04
Nb-95	2E-04
Co-58	2E-04
Mn-54	2E-04
Ag-110m	4E-04
Ac-228	8E-04
Fe-59	6E-04
Zn-65	8E-04
Co-60	4E-04
K-40	6E-03
La-140	4E-04

3.4.2 Airborne Radioiodine

Collection

Airborne radioiodine is collected in an activated charcoal cartridge placed downstream from the glass fibre filter used to collect the airborne particulates. The cartridges used are Nuclear Consulting Services NUSORB (47 mm diameter and 48 mm length) charcoal cartridges containing 5% TEDA by weight. For a 14-day continuous sample approximately 1200 m3 of air is sampled at a flow rate of 60 L/min. The volume of air sampled is measured with an in-line integrating dry gas meter.

Analysis and detection limits

I-131 is the major nuclide of interest on the charcoal cartridges. Adsorbed noble gases and particulates which may have by-passed the filters may also appear. The cartridges are counted for 5000 s on the gamma spectrometer as soon as possible after collection because of the relatively short half life of I-131 (8 days). Other fission product radioiodines, with much shorter half lives (minutes to hours), decay before they

reach the sample location or during the time the sample is being collected. A typical LLD for I-131 is about 4E-04 Bq/m3 of air.

3.4.3 Airborne Tritium

Collection

A fraction of the flow in the air monitoring sample train is diverted through a molecular sieve container where water vapour is extracted from the sampled air. The sieve material is later heated to 450 C and the water driven off is condensed and collected for analysis. A continuous sample is collected from each location to be analysed monthly. Since the amount of water absorbed by the molecular sieve from a given volume of air depends upon relative humidity, flow rates are adjusted seasonally (using a Dwyer flow meter) to avoid saturation of the sieve material and to ensure adequate sample collection.

Analysis and Detection limits

For tritium analysis by liquid scintillation techniques, 6 mL of water taken from the sieve are mixed with 15 mL of Aquasol-II, and counted for 100 minutes. The LLD is approximately 1E-01 Bq/m3 of air for a typical sample, corresponding to about 1E-03% of the tritium DAC for the general public.

3.4.4 Airborne Carbon-14

Collection

Airborne carbon dioxide is collected in a 1 litre volume of 1.0 Normal caustic soda solution at two environmental monitoring locations. One is at the Lighthouse location (G02), and the other is at the Information Centre (H04). The volume of air sampled is assessed by gravimetric analysis of the dissolved carbon dioxide precipitated from solution as barium carbonate.

Analysis and Detection Limits

Carbon-14 is determined by liquid scintillation analysis of a 6mL aliquot of the solution in 15mL of Aquasol-II. The LLD is about 1 Bq/m3 of air.

3.4.5 Environmental Gamma Radiation

Thermoluminescent Dosimetry (TLD)

Environmental gamma radiation is measured by thermo-luminescent dosimetry for each of 30 locations on a quarterly basis. The phosphor is contained in a holder comprising three elements of lead-filtered calcium

sulphate and one of lithium borate (UD-814AQ). The assembly, protected in a thin walled plastic bag, is suspended about 1 m above the ground. The LLD at the 99% confidence level (i.e., 4.66 standard deviations above a well defined background) is approximately 10 microgray.
The expected precision is about +-10% at the 95% confidence level.

Measurements of the ambient radiation levels in the Point Lepreau area are given in Table 4.05A. The data in the 'Total' column are rounded to the nearest ten. The statistical uncertainty shown in the Total column is the square root of the sum of the squares of the uncertainties of the individual quarterly measurements. A summary of TLD results since 1977 is given in Table 4.05B.

Environmental Dose Rate Survey Measurements

Gamma dose rate measurements are taken quarterly on beaches and mud flats in the Point Lepreau area (Beach Surveys) with an environmental gamma survey meter (Nuclear Enterprises type PDR1 or equivalent). In these inter-tidal locations it would be impracticable to use TLDs.

3.4.6 Sediment

Collection and preparation

Beach and mudflat sediments (sand, silt and clay) are collected near the low tide mark with preference being given to the top 50 mm of the finely-divided silts characteristic of tidal mud flats. Disposable polyethylene containers are used to collect about 2 kg of sample which is later transferred to disposable aluminum trays for drying. Dried caked samples are broken into their original free granular form with a porcelain mortar and pestle and sieved through a 0.5 mm sieve to collect the fines for analysis (a 1 mm sieve is used for coarse sediments).

Analysis and Detection Limits

Approximately 0.25 kg of dried sediment is counted for 5000 s on the gamma spectrometry system.

TABLE 3.3

LLD IN SEDIMENTS

Nuclide	LLD (Bq/kg)
Ce-144	2E+01
Ce-141	8E+00
Cr-51	4E+01
I-131	8E+00
Be-7	4E+01
Ru-103	2E+00
Ba-140	2E+01
Cs-134	4E+00
Ru-106	4E+01
Cs-137	6E+00
Zr-95	6E+00
Nb-95	2E+00
Co-58	2E+00
Mn-54	4E+00
Ag-110m	4E+00
Ac-228	4E+01
Fe-59	6E+00
Zn-65	4E+00
Co-60	4E+00
K-40	2E+01
La-140	1E+01

3.4.7 Soil

Several soil samples from around the Solid Radioactive Waste Management Facility were analysed this year to establish the Cs-137 levels in moss, surface-soil and sub-soil. Surface run-off containing suspended soil, draining into the groundwater after a notably dry autumn, was believed to be responsible for the levels of Cs-137 seen in one of the Bore Hole samples for this year. Cs-137, from fallout due to bomb testing, is still detected in fine grained sediments and some vegetation samples. The Cs-137 activity levels noted in these soil samples are consistent with this fallout. No other fallout, or fission product radionuclides, were observed.
Detection limits are comparable with those of sediments.

3.4.8 Water (Well Water/Sea Water)

Collection and Analysis

A 4 litre sample of well water or sea water is collected and acidified with 15 mL of concentrated Nitric acid. About 20 mL of each sample, taken out before acidification, are used for tritium analysis (the sea water is distilled). Well water samples (250-500 mL, depending upon the dissolved solids content) are evaporated to dryness on stainless steel planchets for

gross alpha/beta analysis.
Other water samples collected and analysed include those from Bore Holes in and around the SRWMF; surface run-off from the SRWMF, collected in the Parshall Flume, and Lagoon water samples from within the PLGS exclusion zone.

Analysis and Detection Limits

For gross alpha/beta analysis of well water, dried samples are counted for 100 minutes on a Tennelec alpha/beta counting system.
For tritium analysis, a 6 mL sample of fresh water or sea water distillate is mixed with 15 mL of Aquasol-II and counted for 100 minutes by liquid scintillation.
For gamma spectrometry analysis a 3.6 litre sample is counted for 5000 s on the gamma spectrometer.
Typical LLDs are listed below.

TABLE 3.4

LLD IN WELL WATER AND SEA WATER

Nuclide	Well Water LLD (Bq/L)	Sea Water LLD (Bq/L)
Gross alpha	1E-01	NA
Gross beta	1E-01	NA
H-3	4E+01	4E+01
Ce-144	2E+00	4E+00
Ce-141	1E+00	6E-01
Cr-51	4E+00	4E+00
I-131	4E-01	4E-01
Be-7	4E+00	2E+00
Ru-103	4E-01	4E-01
Ba-140	2E+00	2E+00
Cs-134	4E-01	4E-01
Ru-106	4E+00	2E+00
Cs-137	4E-01	4E-01
Zr-95	6E-01	6E-01
Nb-95	4E-01	4E-01
Co-58	4E-01	4E-01
Mn-54	4E-01	4E-01
Ag-110m	6E-01	4E-01
Ac-228	1E+00	1E+00
Fe-59	1E+00	8E-01
Zn-65	8E-01	6E-01
Co-60	6E-01	4E-01
K-40	1E+01	4E+00
La-140	1E+00	6E-01

NA - Not applicable. Sea water contains relatively high levels of natural radioactivity from K-40 and large amounts of dissolved salts which interfere with these determinations.

3.4.9 Milk

Collection

A 4 litre sample of milk is collected for gamma spectrometric analysis and if necessary preserved by addition of 15 mL of formaldehyde. Distillate from an aliquot of the same sample before addition of preservative is used for tritium analysis.

Analysis and Detection Limits

For tritium analysis by liquid scintillation techniques, a 6 mL sample of distillate is mixed with 15 mL of Aquasol-II and counted for 100 minutes.

For gamma spectrometric analysis, a 3.6 litre sample is analysed for 50000 s (overnight) on a 24% efficient Intrinsic Germanium detector. Typical LLDs for the nuclides of interest in milk are listed below.

TABLE 3.5

LLD IN MILK

Nuclide	LLD (Bq/L)
H-3	4E+01
Ce-144	1E+00
Ce-141	2E-01
Cr-51	1E+00
I-131	1E-01
Be-7	1E+00
Ru-103	1E-01
Ba-140	8E-01
Cs-134	1E-01
Ru-106	1E+00
Cs-137	2E-01
Zr-95	2E-01
Nb-95	2E-01
Co-58	2E-01
Mn-54	2E-01
Ag-110m	1E-01
Ac-228	6E-01
Fe-59	4E-01
Zn-65	4E-01
Co-60	2E+00
K-40	2E+00
La-140	2E-01

3.4.10 Seafood

Collection and Preparation

Approximately 0.5 to 2 kg of fresh seafood is collected for analysis. Those samples which need to be homogenized or compacted prior to analysis are chopped in a blender, e.g., small raw fish and dulse. The crabs, lobsters and periwinkles are cooked before analysis to facilitate removal of the meat. Only the edible fraction of the various seafoods is analysed.
Dulse (Rhodymenia palmata) is the most commonly harvested edible seaweed in the Point Lepreau area. Irish Moss, (Chondrus crispus), is commercially important in other areas of the Bay of Fundy, i.e., St. Mary's Bay, but is not harvested in the Point Lepreau area.
Other species of seaweed, e.g., Laminaria and Ascophylum have been examined for their commercial possibilities, but they are not currently harvested.

Analysis and Detection Limits

Approximately 0.25 kg of each prepared sample is counted for 5000 s on a 24% efficient gamma spectrometer. Typical LLDs are given below.

TABLE 3.6

LLD IN SEAFOOD (EDIBLE FRACTION)

Nuclide	LLD (Bq/kg)
Ce-144	1E+01
Ce-141	4E+00
Cr-51	1E+01
I-131	2E+00
Be-7	2E+01
Ru-103	4E+00
Ba-140	4E+00
Cs-134	2E+00
Ru-106	1E+01
Cs-137	2E+00
Zr-95	2E+00
Nb-95	2E+00
Co-58	2E+00
Mn-54	2E+00
Ag-110m	2E+00
Ac-228	8E+00
Fe-59	4E+00
Zn-65	4E+00
Co-60	2E+00
K-40	2E+01
La-140	2E+00

4.0 SUMMARY TABLES OF ENVIRONMENTAL DATA

The following tables provide a summary of the environmental data collected during the period January 01, 1985 to December 31, 1985.

Table 4.01 Airborne Particulate (Filter).
4.02 Airborne Radioiodine (Charcoal Cartridge).
4.03A Airborne Tritium.
4.03B Airborne Tritium, detailed.
4.03C Airborne Tritium, previous years.
4.04 Airborne Carbon-14.
4.05A Environmental TLDs.
4.05B Environmental TLDs, summary 1977-1985.
4.06 Environmental Gamma Surveys.
4.07A Sediment.
4.07B Cs-137 in Sediment, summary 1978-1985.
4.08 Soil.
4.09 Well Water.
4.10 Bore Hole Water (SRWMF).
4.11 Parshall Flume (SRWMF).
4.12 Lagoon Water (PLGS SITE).
4.13 Sea Water.
4.14 Milk.
4.15 Clams.
4.16 Crabs.
4.17 Dulse.
4.18 Fish.
4.19 Lobster.
4.20 Periwinkles.
4.21 Scallops.
4.22 Sea Plants, (various seaweeds).
4.23 Vegetation.
4.24A Strontium-90 Analyses, (GEM).
4.24B Strontium-90 Analyses, (LEM).

All tables (except Tables 4.03B, 4.03C, 4.04, 4.05A, 4.05B, 4.06, 4.07B, 4.24A, and 4.24B) contain the following data:

Column 1 - This shows the type of analysis or nuclide and, in parentheses, the total number of samples analysed.

Column 2 - This shows the mean of the Critical Levels (CLs) for all samples and, in parentheses, the range of the CLs. Any measurement greater than the CL is considered detected at the 99% confidence level.

Column 3 - This shows the mean of the detected values (i.e., values exceeding the CL) for all indicator stations, followed in parentheses by the ratio (F) of the number of detected values to the total number of indicator samples. Values less than or equal to the CL

are not included in the mean. The second line of the column indicates the range of detected values for the indicator stations.

Column 4 - Shows the location code for the indicator station with the largest value. Refer to the maps of section 2 for sample locations.

Column 5 - Shows the mean of detected values for the indicator station with the largest value, followed in parentheses by the ratio (F) of the number of detected values to the total number of samples for this indicator station. The second line of this column contains the range of detected values for this location.

Column 6 - Shows the mean of detected values at the Reference location(s), followed in parentheses by the ratio (F) of detected values to the total number of samples at this location. The second line of this column contains the range of detected values for the Reference location(s).

There are several exceptions to the above format:

(1) Tables 4.03B and 4.03C list all tritium-in-air data for all air monitoring locations.

(2) Table 4.04. Lists the carbon-14 in air data at the G02 and H04 air monitoring locations.

(3) The environmental TLD data (Table 4.05A) are reported for each quarter. If a quarterly measurement is not available (lost TLD, moisture penetration, etc.) a mean value is calculated from the available measurements in order to provide an estimate for the annual total. The uncertainty in the annual measurement is the square root of the sum of the squares of the quarterly uncertainties, rounded to the nearest multiple of ten. Table 4.05B is a summary of the last nine years of environmental TLD results.

(4) The environmental gamma survey measurements (Beach Surveys) are taken quarterly and are reported for each quarter, (Table 4.06).

(5) A summary of Cs-137 data in sediments since 1978 is presented in table 4.07B. Levels of Cs-137 in the finest grain size sediments have generally decreased to the present time.

(6) The Sr-90 determinations (Tables 4.24A, and B), are tabulated either by week or by month and sample type. The LLD for each sample is a function of background counts and the yield of the analysis (measured by the recovery of added stable strontium carrier).

SUMMARY TABLES
OF
ENVIRONMENTAL DATA

TABLE 4.01 86-03-19

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

AIRBORNE PARTICULATE (FILTER) Bq/m3

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Gross-A (207)	6.3E-06 (2.7E-06-2.1E-05)	2.4E-05 (178/181) (7.8E-06-6.5E-05)	E01	2.7E-05 (24/ 26) (1.3E-05-4.8E-05)	2.2E-05 (26/ 26) (1.0E-05-4.9E-05)
Gross-B (207)	1.7E-05 (8.5E-06-5.1E-05)	4.0E-04 (181/181) (1.8E-04-6.3E-04)	F01	4.2E-04 (26/ 26) (2.1E-04-6.0E-04)	3.3E-04 (26/ 26) (2.1E-04-5.6E-04)
Ce-144 (207)	2.4E-04 (1.0E-04-6.9E-04)	*		*	*
Ce-141 (207)	6.7E-05 (3.0E-05-1.8E-04)	*		*	*
Cr-51 (207)	4.7E-04 (2.4E-04-1.4E-03)	*		*	*
I-131 (207)	1.1E-04 (4.3E-05-2.5E-04)	*		*	*
Be-7 (207)	4.8E-04 (1.9E-04-1.3E-03)	2.8E-03 (180/181) (8.1E-04-6.0E-03)	I01	3.0E-03 (26/ 26) (1.7E-03-5.1E-03)	2.3E-03 (26/ 26) (1.1E-03-4.2E-03)
Ru-103 (207)	5.3E-05 (2.3E-05-1.3E-04)	*		*	*
Ba-140 (207)	3.0E-04 (1.1E-04-6.5E-04)	*		*	*
Cs-134 (207)	4.9E-05 (2.2E-05-1.3E-04)	*		*	*
Ru-106 (207)	4.7E-04 (2.0E-04-1.6E-03)	*		*	*
Cs-137 (207)	5.2E-05 (1.7E-05-1.9E-04)	*		*	*
Zr-95 (207)	9.5E-05 (2.9E-05-3.4E-04)	*		*	*
Nb-95 (207)	5.4E-05 (1.6E-05-1.8E-04)	*		*	*

TABLE 4.01 (Cont'd) 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

AIRBORNE PARTICULATE (FILTER) Bq/m3

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Co-58 (207)	5.3E-05 (2.0E-05-1.5E-04)	*		*	*
Mn-54 (207)	5.1E-05 (1.6E-05-1.7E-04)	*		*	*
Ag-110m (207)	6.9E-05 (2.5E-05-2.2E-04)	*		*	*
Ac-228 (207)	2.0E-04 (6.7E-05-4.4E-04)	*		*	*
Fe-59 (207)	1.2E-04 (3.3E-05-4.1E-04)	*		*	*
Zn-65 (207)	1.2E-04 (4.6E-05-4.2E-04)	*		*	*
Co-60 (207)	6.6E-05 (2.5E-05-1.8E-04)	*		*	*
K-40 (207)	1.0E-03 (2.2E-04-3.7E-03)	1.7E-03 (18/181) (6.8E-04-2.9E-03)	E01	2.2E-03 (4/ 26) (6.8E-04-2.9E-03)	1.3E-03 (1/ 26) (1.3E-03-1.3E-03)
La-140 (207)	1.2E-04 (5.6E-05-5.0E-04)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Nuaber of analyses greater than the Critical Level/Total nuaber of analyses.

TABLE 4.02 86-03-19

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

AIRBORNE IODINE (CHAR. CART.) Bq/m3

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
I-131 (208)	8.5E-05 (3.6E-05-2.4E-04)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.03A

86-03-19

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

AIRBORNE TRITIUM (SIEVE) Bq/m3

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Mean (F) (Range)	Reference Station Mean (F) (Range)
H-3 (104)	7.5E-02 (1.4E-02-2.8E-01)	5.7E-01 (77/ 91) (1.5E-02-3.3E+00)	K02	1.1E+00 (13/ 13) (9.6E-02-3.3E+00)	8.0E-02 (1/ 13) (8.0E-02-8.0E-02)

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.03B

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

Tritium in Air (Bq/m3) — Air Monitoring Stations

PERIOD*	A01R Bocabec	E01 Maces Bay	F01 Welch Cove	G02 Lepreau Light.	H04 Info. Centre	I01 SRWMF	K02 PLGS Pumphouse	N01 Dipper Hbr.
##	45.	4.5	1.5	1.0	0.75	1.0	0.15	3.8
1	<4.6E-2	<4.6E-2	8.2E-2	2.9E-1	1.9E-1	2.7E+0	1.5E-1	4.3E-2
2	<4.1E-2	<4.1E-2	4.6E-2	1.0E-1	1.6E-1	3.1E-1	6.1E-1	3.7E-2
3	<3.6E-2	<3.9E-2	<4.2E-2	2.1E-1	8.1E-1	3.5E-1	9.6E-2	4.6E-2
4	<5.4E-2	4.0E-2	5.3E-2	1.4E-1	8.0E-1	1.4E-1	4.0E-1	1.0E-1
5	<6.5E-2	<1.5E-1	2.0E-1	5.6E-1	1.6E+0	5.3E-1	1.7E+0	1.9E-1
6	<1.0E-1	9.8E-2	<1.0E-1	4.6E-1	1.3E+0	4.1E-1	2.9E+0	2.3E-1
7	<1.8E-1	1.6E-1	2.2E-1	<2.4E-1	2.3E+0	1.2E+0	3.3E+0	5.1E-1
8	<2.5E-1	<1.9E-1	<1.6E-1	<2.8E-1	1.2E+0	5.8E-1	8.9E-1	5.1E-1
9	<1.1E-1	<1.1E-1	<2.6E-1	6.3E-1	1.0E+0	1.1E+0	2.1E+0	1.7E-1
10	<1.3E-1	<1.2E-1	1.2E-1	3.2E-1	1.9E+0	6.1E-1	1.2E+0	2.7E-1
11	8.0E-2	3.2E-2	2.1E-1	3.9E-1	5.9E-1	6.6E-1	7.5E-1	<8.9E-2
12	<1.3E-1	3.1E-2	9.7E-2	3.0E-1	3.5E-1	2.9E-1	1.4E-1	3.4E-2
13	<2.9E-2	1.5E-2	8.2E-2	3.7E-1	8.4E-1	4.2E-1	3.9E-1	5.3E-2

* The periods are approximately of four weeks duration so there are between 12 and 13 periods in the year. In 1985, all tritium sample stations were changed at the same time.

kilometres from PLGS stack.

< These results indicate values below the Lower Limit of Detection.

TABLE 4.03C

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
76-01-01 to 85-12-31

AIRBORNE TRITIUM (MOLECULAR SIEVE) Bq/m3

Year. Samples Analysed	Critical Level Mean (Range)	Indicator Stations Mean(F) (Range)	Reference Station Mean(F) (Range)
1976 to 1979			
68	8.0E-2 (1.5E-2 to 2.1E-1)	1.2E-1 (13/54) (2.1E-2 to 5.6E-1)	2.6E-1 (3/14) (2.6E-2 to 7.2E-1)
1979			
48	6.1E-2 (1.1E-3 to 2.0E-1)	1.1E-1 (6/38) (3.4E-3 to 3.0E-1)	1.1E-1 (1/10) (1.1E-1 to 1.1E-1)
1980			
56	9.9E-2 (2.6E-2 to 3.3E-1)	3.7E-1 (15/44) (8.5E-2 to 3.0E+0)	2.2E-1 (2/12) (8.9E-2 to 3.4E-1)
1981			
52	9.2E-2 (1.3E-2 to 2.4E-1)	1.9E-1 (3/46) (1.2E-1 to 3.3E-1)	7.6E-1 (2/6) (4.3E-1 to 1.1E+0)
1982			
72	5.7E-2 (2.2E-2 to 5.2E-1)	2.2E-1 (18/62) (2.6E-2 to 2.0E+0)	4.9E-2 (2/10) (3.7E-2 to 6.1E-2)
1983			
94	4.5E-2 (2.0E-2 to 1.7E-1)	2.4E-1 (52/82) (3.4E-2 to 1.3E+0)	1.7E-1 (4/12) (8.0E-2 to 2.7E-1)
1984			
101	1.0E-1 (2.3E-2 to 2.7E-1)	7.1E-1 (73/88) (6.0E-2 to 5.6E+0)	1.4E-1 (2/13) (1.0E-1 to 1.8E-1)
1985			
104	7.5E-2 (1.4E-2 to 2.8E-1)	5.7E-1 (77/91) (1.5E-2 to 3.3E+0)	8.0E-2 (1/13) (8.0E-2 to 8.0E-2)

F Number of analyses greater than the Critical Level/total number of analyses.

TABLE 4.04

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

Carbon-14 in Air Monitoring Samples (Bq/m3). Caustic Bubbler

START DATE	STOP DATE	G02 Lighthouse	H04 Information Centre
84-12-19	85-01-16	<1E+00	-----
85-01-16	85-01-30	<2E+00	<2E-01
85-01-30	85-02-12	<5E-01	<3E-01
85-02-12	85-03-13	<2E-01	<2E-01
85-03-13	85-04-10	<3E-01	<2E-01
85-04-10	85-05-08	3E-01 #	<2E-01
85-05-08	85-06-06	<8E-01	<2E+00
85-06-06	85-07-03	<2E-01	<8E-01
85-07-03	85-07-31	<6E-01	<8E-01
85-07-31	85-08-28	<6E-01	<4E-01
85-08-28	85-09-23	<4E-01	<2E-01
85-09-23	85-10-24	<3E-01	<4E-01
85-10-24	85-11-21	<4E-01	<3E-01
85-11-21	85-12-18	<2E-01	<2E-01
85-12-18	86-01-02	<3E-01	<4E-01

Precision is +- 2E-01 Bq/m3 at 95% confidence.

TABLE 4.05A 86-03-19

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Year
1985

TLD (ENVIRONMENTAL) uGy +- 10%

Location	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
A01R	179 +- 18	232 +- 23	226 +- 23	260 +- 26	900 +- 50
B03	192 +- 19	236 +- 24	225 +- 23	234 +- 23	890 +- 40
C03	200 +- 20	244 +- 24	261 +- 26	233 +- 23	940 +- 50
D02	203 +- 20	NA	251 +- 25	234 +- 23	920 +- 40
E01	164 +- 16	214 +- 21	216 +- 22	206 +- 21	800 +- 40
E04	176 +- 18	221 +- 22	195 +- 20	193 +- 19	790 +- 40
F01	155 +- 16	178 +- 18	183 +- 18	172 +- 17	690 +- 30
G02	175 +- 18	201 +- 20	191 +- 19	205 +- 20	770 +- 40
H04	158 +- 16	196 +- 20	177 +- 18	189 +- 19	720 +- 40
H05	158 +- 16	202 +- 20	195 +- 20	202 +- 20	760 +- 40
I00A	237 +- 24	296 +- 30	281 +- 28	280 +- 28	1090 +- 60
I00B	264 +- 26	285 +- 29	265 +- 27	293 +- 29	1110 +- 60
I00C	249 +- 25	301 +- 30	279 +- 28	285 +- 28	1110 +- 60
I00D	243 +- 24	290 +- 29	280 +- 28	281 +- 28	1090 +- 50
I00E	216 +- 22	276 +- 28	273 +- 27	268 +- 27	1030 +- 50
I00F	247 +- 25	269 +- 27	278 +- 28	277 +- 28	1070 +- 50
I00G	254 +- 25	295 +- 30	262 +- 26	292 +- 29	1100 +- 60
I00H	247 +- 25	289 +- 29	281 +- 28	286 +- 29	1100 +- 60
I00I	247 +- 25	282 +- 28	270 +- 27	270 +- 27	1070 +- 50
I00J	222 +- 22	279 +- 28	263 +- 26	264 +- 26	1030 +- 50
I00K	224 +- 22	276 +- 28	260 +- 26	272 +- 27	1030 +- 50
I00L	232 +- 23	280 +- 28	268 +- 27	257 +- 26	1040 +- 50
K01	211 +- 21	251 +- 25	240 +- 24	241 +- 24	940 +- 50
K02	206 +- 21	255 +- 26	230 +- 23	229 +- 23	920 +- 50
L01	196 +- 20	225 +- 23	220 +- 22	205 +- 20	850 +- 40
L02	221 +- 22	283 +- 28	263 +- 26	252 +- 25	1020 +- 50
L03	153 +- 15	189 +- 19	176 +- 18	197 +- 20	720 +- 40
N01	199 +- 20	229 +- 23	241 +- 24	247 +- 25	920 +- 50
P01	153 +- 15	165 +- 17	174 +- 17	175 +- 18	670 +- 30
P03	171 +- 17	206 +- 21	197 +- 20	214 +- 21	790 +- 40

NA : Data not available

TABLE 4.05B

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses
1977 - 1985

TLD (ENVIRONMENTAL)				uGy			Annual absorbed dose		
Location	1977	1978	1979	1980	1981	1982	1983	1984	1985
A01R	640	760	660	660	750	960	840	750	900
B03	690	960	840	740	670	840	820	780	890
C03	880	930	900	850	820	870	910	810	940
D02	660	730	880	810	790	860	890	880	920
E01	620	600	850	670	620	890	740	680	800
E04	700	690	940	800	730	850	710	710	790
F01	700	730	780	960	790	810	650	600	690
G02	700	760	880	780	690	850	720	690	770
H04	570	560	730	540	590	770	650	650	720
H05	630	750	760	670	640	760	720	680	760
I00A +	NA	NA	NA	850*	780	970	980	930	1090
I00B +	NA	NA	NA	960*	1040	990	970	970	1110
I00C +	NA	NA	NA	840*	930	1010	960	1000	1110
I00D +	NA	NA	NA	800*	920	960	970	950	1090
I00E +	NA	NA	NA	830*	890	920	950	970	1030
I00F +	NA	NA	NA	830*	930	900	940	960	1070
I00G +	NA	NA	NA	840*	960	940	910	910	1100
I00H +	NA	NA	NA	850*	1000	1010	960	960	1100
I00I +	NA	NA	NA	780*	970	920	930	910	1070
I00J +	NA	NA	NA	890*	910	850	880	910	1030
I00K +	NA	NA	NA	750*	820	920	880	920	1030
I00L +	NA	NA	NA	920*	1070	900	960	920	1040
K01	650	690	1090	830	790	900	850	820	940
K02	NA	NA	NA	NA	NA	NA	830	850	920
L01	640	710	880	790	680	830	780	750	850
L02	760	840	1000	870	930	990	920	910	1020
L03	640	550	660	640	570	770	650	630	720
N01	550	780	1040	660	680	890	850	800	920
P01	530	560	690	550	490	660	610	580	670
P03	800	710	730	650	680	750	720	690	790

* The I00 locations around the SRWMF fence came into use in mid 1980.

\+ These I00 locations were previously identified as I04.

NA TLDs not used in these locations at this time.

TABLE 4.06

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

ENVIRONMENTAL GAMMA SURVEYS (BEACH)	microgray/h *			INTERTIDAL ZONES
Location	Quarter 1	Quarter 2	Quarter 3	Quarter 4
B01	0.14	0.19	0.13	0.13
C01	0.13	0.12	0.10	0.12
D01	0.17	0.18	0.15	0.13
D04	0.14	0.14	0.17	0.13
E03	0.15	0.14	0.10	0.09
G01	0.11	0.13	0.14	0.12
H03	0.14	0.11	0.17	0.11
N04	0.13	0.11	0.13	0.13
P02	0.17	0.16	0.16	0.17
Q01R	0.13	0.11	0.10	0.10

* Although two decimal places are quoted, none of the determinations has this degree of precision nor accuracy. The data are quoted to two figures just as they are estimated at each location. They should all be regarded as about 0.1 microgray.

TABLE 4.07A
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

86-03-19

SEDIMENT Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ce-144 (41)	6.2E+00 (4.1E+00-1.1E+01)	*		*	*
Ce-141 (41)	1.6E+00 (1.0E+00-2.9E+00)	*		*	*
Cr-51 (41)	8.4E+00 (5.5E+00-1.9E+01)	*		*	*
I-131 (41)	1.7E+00 (8.8E-01-4.3E+00)	*		*	*
Be-7 (41)	8.2E+00 (4.4E+00-1.6E+01)	2.7E+01 (14/ 37) (1.1E+01-7.7E+01)	D04	3.9E+01 (4/ 4) (2.0E+01-7.7E+01)	2.1E+01 (4/ 4) (1.7E+01-2.6E+01)
Ru-103 (41)	9.2E-01 (4.7E-01-1.9E+00)	*		*	*
Ba-140 (41)	5.0E+00 (2.7E+00-9.4E+00)	*		*	*
Cs-134 (41)	8.1E-01 (5.3E-01-1.6E+00)	*		*	*
Ru-106 (41)	7.9E+00 (4.8E+00-1.6E+01)	*		*	*
Cs-137 (41)	1.1E+00 (6.3E-01-2.2E+00)	4.3E+00 (9/ 37) (2.4E+00-9.7E+00)	D04	5.7E+00 (4/ 4) (3.5E+00-9.7E+00)	1.8E+00 (2/ 4) (1.8E+00-1.8E+00)
Zr-95 (41)	1.8E+00 (1.3E+00-4.1E+00)	*		*	*
Nb-95 (41)	9.9E-01 (6.2E-01-2.0E+00)	*		*	*
Co-58 (41)	9.0E-01 (5.6E-01-1.9E+00)	*		*	*
Mn-54 (41)	9.4E-01 (6.2E-01-1.8E+00)	*		*	*

TABLE 4.07A (Cont'd) 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

SEDIMENT Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ag-110m (41)	1.2E+00 (7.1E-01-2.7E+00)	*		*	*
Ac-228 (41)	3.4E+00 (2.0E+00-6.9E+00)	1.8E+01 (37/ 37) (9.1E+00-3.2E+01)	D01	3.1E+01 (4/ 4) (2.9E+01-3.2E+01)	2.5E+01 (4/ 4) (2.3E+01-2.8E+01)
Fe-59 (41)	2.4E+00 (1.4E+00-4.8E+00)	*		*	*
Zn-65 (41)	2.5E+00 (1.5E+00-4.8E+00)	*		*	*
Co-60 (41)	1.1E+00 (5.3E-01-2.4E+00)	*		*	*
K-40 (41)	9.1E+00 (3.8E+00-1.8E+01)	5.3E+02 (37/ 37) (4.1E+02-6.9E+02)	D01	6.0E+02 (4/ 4) (5.4E+02-6.9E+02)	4.4E+02 (4/ 4) (4.0E+02-4.7E+02)
La-140 (41)	1.4E+00 (6.0E-01-3.6E+00)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.07B

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
1978 to 1985

Cs-137 IN SEDIMENTS (Bq/kg). GAMMA SPECTROMETRIC ANALYSIS

LOCATION	B01	C01	D01	D04	E03	G01	H03	N04	P02	Q01R
PERIOD	*	+	+	+	*	*	*	*	*	+
1978	<1.3	3.6	7.8	---	<5.0	<2.1	<1.5	<2.1	<1.6	7.0
1979 1	<0.9	8.2	8.6	5.9	<2.2	<2.3	<1.5	<2.2	<1.5	9.2
1979 2	<0.8	3.9	4.8	5.7	<1.0	3.7	<1.9	<1.5	<1.0	3.8
1979 3	<0.8	4.2	3.8	11.5	<0.7	<2.1	1.9	<1.7	<1.4	3.4
1979 4	<1.2	3.2	4.1	4.4	<1.1	<2.3	<1.0	2.9	<1.0	5.3
1980 1	<2.1	3.5	3.3	8.3	<1.7	<3.0	<1.1	<1.6	<1.4	9.0
1980 2	<1.5	2.4	5.7	14.0	<1.3	1.4	<0.9	<1.2	<2.0	6.6
1980 3	<1.1	2.6	5.3	14.5	<1.2	<2.8	<1.1	<1.0	<4.2	4.8
1980 4	<1.4	3.4	2.6	8.5	<0.7	<2.8	<1.7	<0.9	<1.5	1.9
1981 1	<0.7	2.3	3.7	7.6	<1.3	1.3	<1.1	2.2	<0.8	5.3
1981 2	1.5	2.5	3.5	10.9	<0.8	1.0	<0.9	<1.6	<1.4	5.6
1981 3	<1.1	1.8	4.4	8.5	<0.9	<0.9	<1.5	<1.9	<1.1	4.7
1981 4	<1.7	3.2	4.1	12.7	<1.0	<2.1	<1.6	<2.7	<1.6	5.5
1982 1	<1.0	1.9	3.9	6.3	<1.1	1.7	<1.6	<2.2	<1.0	4.7
1982 2	<0.9	3.3	4.5	8.2	<1.7	<2.4	<1.2	<1.7	<1.9	5.7
1982 3	<1.3	3.1	10.0	6.3	<2.3	<5.0	<1.0	3.0	<4.1	5.6
1982 4	<0.8	5.6	4.7	8.2	<1.3	<2.4	<2.3	2.4	<1.4	7.3
1983 1	<1.5	<2.1	5.1	6.3	<1.0	<5.5	<2.4	<3.4	<1.9	<6.8
1983 2	<1.7	3.3	<4.7	6.0	<1.2	<3.5	<2.9	<3.9	<1.2	4.6
1983 3	<1.4	<1.5	3.7	6.4	<1.3	<6.9	<2.6	<1.9	<1.1	<5.6
1983 4	<1.5	2.7	<3.8	4.5	<1.1	<2.0	<1.1	<2.0	<1.7	<1.6
1984 1	<1.9	<3.4	4.3	5.3	<2.1	<8.6	<1.7	<2.5	<1.6	4.0
1984 2	<1.0	<2.7	2.3	6.5	<1.4	<1.0	<0.9	<1.7	<1.0	3.1
1984 3	<1.2	<2.6	3.5	5.0	<1.6	<1.5	<0.9	<0.9	<1.6	4.9
1984 4	<1.9	<2.2	3.5	11.9	<1.7	<2.2	<2.6	<2.7	<3.9	3.2
1985 1	<1.1	<1.8	3.0	5.3	<0.6	<1.9	<1.6	<1.4	<0.9	<2.1
1985 2	<1.3	<1.3	<4.0	4.4	<1.2	<1.5	<1.5	<2.1	<1.5	1.8
1985 3	<0.8	<1.1	3.7	9.7	<1.8	<0.9	<1.6	<1.0	<2.0	1.8
1985 4	<1.4	2.4	4.3	3.5	<1.2	<2.1	<1.2	<1.2	<1.3	<1.4

Values with a < symbol were not detected.

* Coarse grained sediment. The Cation Exchange Capacity (CEC) is minimal.

\+ Clay rich sediment. The CEC is high.
Large variations in the values of columns 3, 4 and 10, are the result of inhomogeneous distribution of Cs-137 in the area sampled.

TABLE 4.08 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

SOIL Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ce-144 (4)	8.5E+00 (6.5E+00-1.4E+01)	*		*	*
Ce-141 (4)	2.1E+00 (1.6E+00-3.3E+00)	*		*	*
Cr-51 (4)	1.3E+01 (7.7E+00-2.4E+01)	*		*	*
I-131 (4)	2.0E+00 (1.4E+00-3.2E+00)	*		*	*
Be-7 (4)	1.2E+01 (7.2E+00-2.2E+01)	6.5E+01 (2/ 4) (3.1E+01-9.8E+01)	I00C	9.8E+01 (1/ 3) (9.8E+01-9.8E+01)	*
Ru-103 (4)	1.3E+00 (8.3E-01-2.4E+00)	*		*	*
Ba-140 (4)	5.9E+00 (3.9E+00-9.5E+00)	*		*	*
Cs-134 (4)	1.1E+00 (6.9E-01-2.1E+00)	*		*	*
Ru-106 (4)	1.1E+01 (6.5E+00-2.0E+01)	*		*	*
Cs-137 (4)	1.4E+00 (8.7E-01-2.5E+00)	5.1E+01 (3/ 4) (6.9E+00-1.1E+02)	I00C	5.1E+01 (3/ 3) (6.9E+00-1.1E+02)	*
Zr-95 (4)	1.8E+00 (1.2E+00-3.1E+00)	*		*	*
Nb-95 (4)	1.2E+00 (8.4E-01-1.9E+00)	*		*	*
Co-58 (4)	1.1E+00 (6.1E-01-2.1E+00)	*		*	*
Mn-54 (4)	9.4E-01 (7.1E-01-1.4E+00)	*		*	*

TABLE 4.08 (Cont'd) 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

SOIL Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ag-110m (4)	1.1E+00 (8.8E-01-1.5E+00)	*		*	*
Ac-228 (4)	4.0E+00 (2.1E+00-7.4E+00)	1.7E+01 (3/ 4) (7.7E+00-2.3E+01)	I01	2.3E+01 (1/ 1) (2.3E+01-2.3E+01)	*
Fe-59 (4)	2.5E+00 (1.9E+00-3.7E+00)	*		*	*
Zn-65 (4)	2.5E+00 (1.9E+00-3.8E+00)	*		*	*
Co-60 (4)	1.3E+00 (9.2E-01-2.4E+00)	*		*	*
K-40 (4)	9.7E+00 (7.1E+00-1.3E+01)	3.7E+02 (4/ 4) (7.3E+01-7.0E+02)	I01	7.0E+02 (1/ 1) (7.0E+02-7.0E+02)	*
La-140 (4)	1.4E+00 (1.1E+00-1.7E+00)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.09 86-03-19

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

WELL WATER Bq/L

Analysis Type (Total Nuaber)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Mean (F) (Range)	Reference Station Mean (F) (Range)
Gross-A (18)	3.9E-02 (1.9E-02-9.2E-02)	1.2E-01 (12/ 16) (2.9E-02-2.4E-01)	D03	1.7E-01 (2/ 2) (9.6E-02-2.4E-01)	7.7E-02 (1/ 2) (7.7E-02-7.7E-02)
Gross-B (18)	2.5E-02 (2.2E-02-3.0E-02)	8.9E-02 (13/ 16) (3.6E-02-1.8E-01)	D03	1.6E-01 (2/ 2) (1.4E-01-1.8E-01)	4.4E-02 (1/ 2) (4.4E-02-4.4E-02)
H-3 (18)	1.8E+01 (1.7E+01-1.8E+01)	*		*	*
Ce-144 (18)	1.5E+00 (1.0E+00-2.5E+00)	*		*	*
Ce-141 (18)	3.4E-01 (2.3E-01-5.7E-01)	*		*	*
Cr-51 (18)	1.5E+00 (1.1E+00-2.5E+00)	*		*	*
I-131 (18)	2.1E-01 (1.4E-01-3.3E-01)	*		*	*
Be-7 (18)	1.4E+00 (1.1E+00-2.2E+00)	*		*	*
Ru-103 (18)	1.6E-01 (9.5E-02-2.3E-01)	*		*	*
Ba-140 (18)	6.9E-01 (4.5E-01-1.1E+00)	*		*	*
Cs-134 (18)	1.5E-01 (9.5E-02-2.2E-01)	*		*	*
Ru-106 (18)	1.4E+00 (1.1E+00-1.9E+00)	*		*	*
Cs-137 (18)	1.6E-01 (7.5E-02-2.3E-01)	*		*	*
Zr-95 (18)	2.6E-01 (1.5E-01-4.1E-01)	*		*	*

TABLE 4.09 (Cont'd) 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

WELL WATER Bq/L

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Mean (F) (Range)	Reference Station Mean (F) (Range)
Nb-95 (18)	1.5E-01 (8.5E-02-2.4E-01)	*		*	*
Co-58 (18)	1.4E-01 (9.0E-02-2.3E-01)	*		*	*
Mn-54 (18)	1.5E-01 (8.8E-02-2.8E-01)	*		*	*
Ag-110m (18)	2.0E-01 (1.4E-01-3.0E-01)	*		*	*
Ac-228 (18)	5.4E-01 (3.3E-01-1.0E+00)	*		*	*
Fe-59 (18)	3.4E-01 (1.5E-01-5.5E-01)	*		*	*
Zn-65 (18)	3.6E-01 (2.7E-01-5.8E-01)	*		*	*
Co-60 (18)	1.8E-01 (9.1E-02-2.4E-01)	*		*	*
K-40 (18)	2.3E+00 (2.0E+00-2.8E+00)	*		*	*
La-140 (18)	2.3E-01 (1.5E-01-3.5E-01)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.10 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

BORE HOLE WATER Bq/L

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Mean (F) (Range)	Reference Station Mean (F) (Range)
H-3 (15)	1.8E+01 (1.8E+01-2.1E+01)	1.6E+02 (12/ 15) (2.3E+01-4.6E+02)	I00A	1.9E+02 (5/ 5) (2.3E+01-4.6E+02)	*
Ce-144 (15)	1.1E+00 (9.2E-01-1.6E+00)	*		*	*
Ce-141 (15)	2.8E-01 (2.2E-01-4.4E-01)	*		*	*
Cr-51 (15)	1.3E+00 (9.9E-01-2.0E+00)	*		*	*
I-131 (15)	2.2E-01 (1.6E-01-4.2E-01)	*		*	*
Be-7 (15)	1.2E+00 (8.6E-01-1.9E+00)	*		*	*
Ru-103 (15)	1.3E-01 (1.0E-01-1.7E-01)	*		*	*
Ba-140 (15)	5.9E-01 (3.7E-01-8.0E-01)	*		*	*
Cs-134 (15)	1.2E-01 (9.8E-02-1.8E-01)	*		*	*
Ru-106 (15)	1.3E+00 (9.4E-01-2.2E+00)	*		*	*
Cs-137 (15)	1.5E-01 (1.1E-01-2.8E-01)	4.6E-01 (1/ 15) (4.6E-01-4.6E-01)	I00C	4.6E-01 (1/ 5) (4.6E-01-4.6E-01)	*
Zr-95 (15)	2.1E-01 (1.4E-01-2.9E-01)	*		*	*
Nb-95 (15)	1.2E-01 (6.8E-02-2.2E-01)	*		*	*
Co-58 (15)	1.3E-01 (7.9E-02-2.3E-01)	*		*	*

TABLE 4.10 (Cont'd) 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

BORE HOLE WATER Bq/L

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Mn-54 (15)	1.2E-01 (6.3E-02-1.8E-01)	*		*	*
Ag-110m (15)	1.5E-01 (6.4E-02-2.4E-01)	*		*	*
Ac-228 (15)	5.3E-01 (3.6E-01-6.9E-01)	*		*	*
Fe-59 (15)	3.0E-01 (1.8E-01-4.1E-01)	*		*	*
Zn-65 (15)	2.9E-01 (1.1E-01-3.7E-01)	*		*	*
Co-60 (15)	1.5E-01 (6.5E-02-2.2E-01)	*		*	*
K-40 (15)	2.0E+00 (1.3E+00-2.8E+00)	4.0E+00 (2/ 15) (3.2E+00-4.7E+00)	100A	4.7E+00 (1/ 5) (4.7E+00-4.7E+00)	*
La-140 (15)	2.0E-01 (9.7E-02-3.4E-01)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.11 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

PARSHALL FLUME, (SRWMF) Bq/L

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
H-3 (67)	1.8E+01 (1.7E+01-2.7E+01)	1.4E+02 (54/ 67) (1.9E+01-3.2E+03)	I01	1.4E+02 (54/ 67) (1.9E+01-3.2E+03)	*
Ce-144 (67)	1.1E+00 (8.4E-01-2.1E+00)	*		*	*
Ce-141 (67)	3.1E-01 (2.1E-01-5.7E-01)	*		*	*
Cr-51 (67)	1.6E+00 (9.8E-01-2.6E+00)	*		*	*
I-131 (67)	4.0E-01 (1.6E-01-1.1E+00)	*		*	*
Be-7 (67)	1.4E+00 (8.5E-01-2.8E+00)	*		*	*
Ru-103 (67)	1.6E-01 (9.7E-02-3.3E-01)	*		*	*
Ba-140 (67)	9.2E-01 (3.8E-01-1.8E+00)	*		*	*
Cs-134 (67)	1.3E-01 (6.9E-02-2.4E-01)	*		*	*
Ru-106 (67)	1.3E+00 (5.1E-01-2.8E+00)	*		*	*
Cs-137 (67)	1.5E-01 (8.6E-02-3.5E-01)	*		*	*
Zr-95 (67)	2.5E-01 (1.1E-01-5.2E-01)	*		*	*
Nb-95 (67)	1.5E-01 (8.0E-02-3.0E-01)	*		*	*
Co-58 (67)	1.4E-01 (4.8E-02-3.2E-01)	*		*	*

TABLE 4.11 (Cont'd)
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

86-03-19

PARSHALL FLUME, (SRWMF) Bq/L

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Mn-54 (67)	1.4E-01 (7.8E-02-3.2E-01)	*		*	*
Ag-110m (67)	1.7E-01 (6.4E-02-4.7E-01)	*		*	*
Ac-228 (67)	5.3E-01 (2.8E-01-1.2E+00)	*		*	*
Fe-59 (67)	3.3E-01 (1.3E-01-8.7E-01)	*		*	*
Zn-65 (67)	3.1E-01 (1.1E-01-7.3E-01)	*		*	*
Co-60 (67)	1.7E-01 (6.5E-02-4.0E-01)	*		*	*
K-40 (67)	2.2E+00 (6.5E-01-5.1E+00)	*		*	*
La-140 (67)	3.1E-01 (1.1E-01-7.0E-01)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.12 86-03-19

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

LAGOON WATER Bq/L

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Mean (F) (Range)	Reference Station Mean (F) (Range)
H-3 (32)	2.2E+01 (1.8E+01-1.1E+02)	2.5E+03 (31/ 32) (2.2E+01-6.7E+04)	K03W	7.1E+03 (10/ 10) (2.7E+02-6.7E+04)	*
Gd-153 (32)	7.8E-01 (6.3E-01-9.4E-01)	*		*	*
Ce-144 (32)	1.7E+00 (1.4E+00-2.3E+00)	*		*	*
Mo-99 (32)	1.5E+00 (3.1E-01-4.5E+00)	*		*	*
Ce-141 (32)	4.4E-01 (3.6E-01-5.6E-01)	*		*	*
Np-239 (32)	1.5E+01 (2.9E+00-4.8E+01)	*		*	*
Cr-51 (32)	2.4E+00 (1.9E+00-3.3E+00)	*		*	*
Gd-159 (32)	1.2E+04 (9.9E+00-1.1E+05)	*		*	*
I-131 (32)	4.4E-01 (2.6E-01-7.6E-01)	*		*	*
Ru-103 (32)	2.7E-01 (1.9E-01-3.6E-01)	*		*	*
Ba-140 (32)	1.3E+00 (8.8E-01-2.0E+00)	*		*	*
Cs-134 (32)	2.4E-01 (1.7E-01-3.2E-01)	*		*	*
Ru-106 (32)	2.3E+00 (1.5E+00-3.1E+00)	*		*	*
Cs-137 (32)	2.5E-01 (1.3E-01-3.5E-01)	*		*	*

TABLE 4.12 (Cont'd)
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

86-03-19

LAGOON WATER Bq/L

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Zr-95 (32)	4.7E-01 (2.9E-01-6.3E-01)	*		*	*
Nb-95 (32)	2.5E-01 (9.1E-02-3.6E-01)	*		*	*
Co-58 (32)	2.4E-01 (1.1E-01-3.5E-01)	*		*	*
Mn-54 (32)	2.5E-01 (1.3E-01-3.4E-01)	*		*	*
Ag-110M (32)	3.3E-01 (1.9E-01-4.7E-01)	*		*	*
Sc-46 (32)	2.6E-01 (1.4E-01-4.0E-01)	*		*	*
Fe-59 (32)	5.3E-01 (2.6E-01-8.0E-01)	*		*	*
Zn-65 (32)	5.3E-01 (2.4E-01-8.3E-01)	*		*	*
Co-60 (32)	3.0E-01 (1.4E-01-4.3E-01)	*		*	*
La-140 (32)	4.5E-01 (1.9E-01-6.5E-01)	*		*	*
Sb-124 (32)	6.4E-01 (3.7E-01-1.0E+00)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

86-03-19

TABLE 4.13
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

SEA WATER Bq/L

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
H-3 (17)	1.8E+01 (1.8E+01-1.9E+01)	*		*	*
Ce-144 (17)	1.1E+00 (9.3E-01-1.2E+00)	*		*	*
Ce-141 (17)	2.5E-01 (1.9E-01-3.0E-01)	*		*	*
Cr-51 (17)	1.2E+00 (9.9E-01-1.4E+00)	*		*	*
I-131 (17)	2.1E-01 (1.4E-01-3.1E-01)	*		*	*
Be-7 (17)	1.2E+00 (7.7E-01-1.4E+00)	*		*	*
Ru-103 (17)	1.3E-01 (9.2E-02-1.6E-01)	*		*	*
Ba-140 (17)	6.3E-01 (5.0E-01-9.4E-01)	*		*	*
Cs-134 (17)	1.2E-01 (8.5E-02-1.4E-01)	*		*	*
Ru-106 (17)	1.1E+00 (8.0E-01-1.5E+00)	*		*	*
Cs-137 (17)	1.3E-01 (9.6E-02-1.8E-01)	*		*	*
Zr-95 (17)	2.1E-01 (1.1E-01-3.0E-01)	*		*	*
Nb-95 (17)	1.2E-01 (7.6E-02-1.7E-01)	*		*	*
Co-58 (17)	1.2E-01 (6.5E-02-1.5E-01)	*		*	*

TABLE 4.13 (Cont'd) 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

SEA WATER Bq/L

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Mn-54 (17)	1.2E-01 (1.0E-01-1.5E-01)	*		*	*
Ag-110m (17)	1.6E-01 (1.1E-01-2.2E-01)	*		*	*
Ac-228 (17)	4.4E-01 (3.3E-01-5.6E-01)	*		*	*
Fe-59 (17)	2.6E-01 (1.5E-01-3.8E-01)	*		*	*
Zn-65 (17)	2.8E-01 (1.6E-01-3.9E-01)	*		*	*
Co-60 (17)	1.4E-01 (9.1E-02-1.9E-01)	*		*	*
K-40 (17)	1.3E+00 (6.5E-01-1.9E+00)	1.2E+01 (13/ 13) (9.3E+00-1.5E+01)	H02	1.2E+01 (1/ 1) (1.2E+01-1.2E+01)	8.8E+00 (4/ 4) (6.6E+00-1.2E+01)
La-140 (17)	2.1E-01 (1.0E-01-3.0E-01)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.14
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

86-03-19

MILK Bq/L

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
H-3 (20)	1.8E+01 (1.7E+01-1.9E+01)	*		*	*
Ce-144 (20)	3.6E-01 (3.3E-01-4.8E-01)	*		*	*
Ce-141 (20)	8.3E-02 (7.6E-02-1.1E-01)	*		*	*
Cr-51 (20)	4.1E-01 (3.7E-01-6.2E-01)	*		*	*
I-131 (20)	5.7E-02 (4.6E-02-8.6E-02)	*		*	*
Be-7 (20)	4.0E-01 (3.6E-01-6.3E-01)	*		*	*
Ru-103 (20)	4.7E-02 (4.3E-02-7.0E-02)	*		*	*
Ba-140 (20)	1.9E-01 (1.5E-01-3.0E-01)	*		*	*
Cs-134 (20)	4.4E-02 (4.0E-02-7.4E-02)	*		*	*
Ru-106 (20)	4.3E-01 (3.7E-01-6.9E-01)	*		*	*
Cs-137 (20)	5.4E-02 (4.1E-02-8.5E-02)	1.1E-01 (4/ 8) (7.9E-02-1.5E-01)	X10	1.2E-01 (2/ 4) (8.1E-02-1.5E-01)	9.4E-02 (1/ 12) (9.4E-02-9.4E-02)
Zr-95 (20)	8.3E-02 (7.2E-02-1.3E-01)	*		*	*
Nb-95 (20)	4.7E-02 (4.1E-02-8.0E-02)	*		*	*
Co-58 (20)	4.8E-02 (4.2E-02-7.3E-02)	*		*	*

TABLE 4.14 (Cont'd)
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

86-03-19

MILK Bq/L

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Mn-54 (20)	4.8E-02 (4.2E-02-7.3E-02)	*		*	*
Ag-110m (20)	6.5E-02 (5.5E-02-9.5E-02)	*		*	*
Ac-228 (20)	1.8E-01 (1.5E-01-2.8E-01)	*		*	3.0E-01 (1/ 12) (3.0E-01-3.0E-01)
Fe-59 (20)	1.2E-01 (1.1E-01-1.8E-01)	*		*	*
Zn-65 (20)	1.3E-01 (1.2E-01-2.0E-01)	*		*	*
Co-60 (20)	5.9E-02 (5.1E-02-9.4E-02)	*		*	*
K-40 (20)	5.6E-01 (4.6E-01-9.1E-01)	5.0E+01 (8/ 8) (4.8E+01-5.2E+01)	X10	5.1E+01 (4/ 4) (4.9E+01-5.2E+01)	5.0E+01 (12/ 12) (4.8E+01-5.2E+01)
La-140 (20)	5.4E-02 (4.3E-02-8.4E-02)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.15 86-03-19

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

CLAMS (EDIBLE, RAW MASS) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Mean (F) (Range)	Reference Station Mean (F) (Range)
Ce-144 (13)	5.0E+00 (2.8E+00-7.1E+00)	*		*	*
Ce-141 (13)	1.2E+00 (8.0E-01-1.8E+00)	*		*	*
Cr-51 (13)	7.2E+00 (4.8E+00-1.0E+01)	*		*	*
I-131 (13)	1.1E+00 (6.2E-01-1.8E+00)	*		*	*
Be-7 (13)	7.7E+00 (5.0E+00-1.1E+01)	*		*	*
Ru-103 (13)	9.1E-01 (4.5E-01-1.6E+00)	*		*	*
Ba-140 (13)	3.7E+00 (2.4E+00-6.2E+00)	*		*	*
Cs-134 (13)	8.0E-01 (5.6E-01-1.4E+00)	*		*	*
Ru-106 (13)	8.5E+00 (4.7E+00-1.4E+01)	*		*	*
Cs-137 (13)	9.9E-01 (4.2E-01-1.5E+00)	*		*	*
Zr-95 (13)	1.6E+00 (9.7E-01-2.5E+00)	*		*	*
Nb-95 (13)	9.2E-01 (5.7E-01-1.4E+00)	*		*	*
Co-58 (13)	8.3E-01 (4.9E-01-1.2E+00)	*		*	*
Mn-54 (13)	8.3E-01 (4.8E-01-1.1E+00)	*		*	*

TABLE 4.15 (Cont'd) 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

CLAMS (EDIBLE, RAW MASS) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ag-110m (13)	1.1E+00 (7.4E-01-1.9E+00)	*		*	*
Ac-228 (13)	4.0E+00 (2.1E+00-6.6E+00)	8.8E+00 (1/ 12) (8.8E+00-8.8E+00)	C01	8.8E+00 (1/ 4) (8.8E+00-8.8E+00)	*
Fe-59 (13)	1.9E+00 (9.7E-01-2.9E+00)	*		*	*
Zn-65 (13)	2.2E+00 (1.5E+00-3.3E+00)	*		*	*
Co-60 (13)	1.1E+00 (4.3E-01-1.6E+00)	*		*	*
K-40 (13)	9.5E+00 (3.7E+00-1.5E+01)	8.2E+01 (12/ 12) (5.0E+01-1.2E+02)	C01	9.2E+01 (4/ 4) (5.9E+01-1.2E+02)	6.8E+01 (1/ 1) (6.8E+01-6.8E+01)
La-140 (13)	1.2E+00 (7.0E-01-1.9E+00)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.16 86-03-19

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

CRAB (EDIBLE, COOKED MASS) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ce-144 (2)	9.4E+00 (8.1E+00-1.1E+01)	*		*	*
Ce-141 (2)	2.7E+00 (2.5E+00-2.8E+00)	*		*	*
Cr-51 (2)	1.6E+01 (1.5E+01-1.7E+01)	*		*	*
I-131 (2)	5.4E+00 (5.0E+00-5.8E+00)	*		*	*
Be-7 (2)	1.4E+01 (1.4E+01-1.5E+01)	*		*	*
Ru-103 (2)	1.8E+00 (1.7E+00-1.9E+00)	*		*	*
Ba-140 (2)	9.7E+00 (9.3E+00-1.0E+01)	*		*	*
Cs-134 (2)	1.4E+00 (9.8E-01-1.8E+00)	*		*	*
Ru-106 (2)	1.5E+01 (1.2E+01-1.9E+01)	*		*	*
Cs-137 (2)	1.8E+00 (1.6E+00-1.9E+00)	*		*	*
Zr-95 (2)	2.6E+00 (2.5E+00-2.7E+00)	*		*	*
Nb-95 (2)	1.8E+00 (1.5E+00-2.0E+00)	*		*	*
Co-58 (2)	1.5E+00 (1.2E+00-1.8E+00)	*		*	*
Mn-54 (2)	1.1E+00 (9.3E-01-1.3E+00)	*		*	*

TABLE 4.16 (Cont'd) 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

CRAB (EDIBLE, COOKED MASS) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ag-110m (2)	1.7E+00 (1.5E+00-1.9E+00)	*		*	*
Ac-228 (2)	6.5E+00 (5.5E+00-7.5E+00)	*		*	*
Fe-59 (2)	5.0E+00 (4.9E+00-5.2E+00)	*		*	*
Zn-65 (2)	3.9E+00 (3.8E+00-4.0E+00)	*		*	*
Co-60 (2)	1.5E+00 (1.4E+00-1.6E+00)	*		*	*
K-40 (2)	1.9E+01 (1.5E+01-2.2E+01)	1.0E+02 (2/ 2) (8.1E+01-1.2E+02)	H02	1.2E+02 (1/ 1) (1.2E+02-1.2E+02)	*
La-140 (2)	2.8E+00 (2.6E+00-3.0E+00)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.17 86-03-19

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

DULSE (WET MASS) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Mean (F) (Range)	Reference Station Mean (F) (Range)
Ce-144 (9)	1.0E+01 (5.3E+00-1.8E+01)	*		*	*
Ce-141 (9)	2.4E+00 (1.2E+00-4.1E+00)	*		*	*
Cr-51 (9)	1.3E+01 (7.1E+00-2.4E+01)	*		*	*
I-131 (9)	2.1E+00 (1.2E+00-3.5E+00)	*		*	*
Be-7 (9)	1.4E+01 (7.1E+00-2.6E+01)	*		*	*
Ru-103 (9)	1.7E+00 (9.3E-01-3.2E+00)	*		*	*
Ba-140 (9)	6.8E+00 (3.7E+00-1.1E+01)	*		*	*
Cs-134 (9)	1.6E+00 (6.7E-01-3.2E+00)	*		*	*
Ru-106 (9)	1.5E+01 (8.1E+00-3.0E+01)	*		*	*
Cs-137 (9)	1.9E+00 (9.8E-01-3.6E+00)	*		*	*
Zr-95 (9)	2.6E+00 (1.4E+00-4.5E+00)	*		*	*
Nb-95 (9)	1.7E+00 (7.6E-01-2.9E+00)	*		*	*
Co-58 (9)	1.6E+00 (8.2E-01-3.2E+00)	*		*	*
Mn-54 (9)	1.6E+00 (8.5E-01-3.2E+00)	*		*	*

TABLE 4.17 (Cont'd)
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

86-03-19

DULSE (WET MASS) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ag-110m (9)	2.2E+00 (1.1E+00-4.0E+00)	*		*	*
Ac-228 (9)	6.4E+00 (3.3E+00-1.1E+01)	*		*	*
Fe-59 (9)	3.7E+00 (2.4E+00-6.1E+00)	*		*	*
Zn-65 (9)	4.1E+00 (2.1E+00-7.3E+00)	*		*	*
Co-60 (9)	2.1E+00 (1.0E+00-4.3E+00)	*		*	*
K-40 (9)	1.9E+01 (8.5E+00-3.7E+01)	3.5E+02 (9/ 9) (1.9E+02-5.6E+02)	G01	4.5E+02 (1/ 1) (4.5E+02-4.5E+02)	*
La-140 (9)	2.0E+00 (1.2E+00-2.9E+00)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.18 86-03-19

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

FISH, VARIOUS, EDIBLE RAW MASS Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ce-144 (13)	4.0E+00 (3.0E+00-6.5E+00)	*		*	*
Ce-141 (13)	1.1E+00 (7.2E-01-1.9E+00)	*		*	*
Cr-51 (13)	6.9E+00 (4.3E+00-1.1E+01)	*		*	*
I-131 (13)	1.9E+00 (5.2E-01-4.3E+00)	*		*	*
Be-7 (13)	6.1E+00 (3.5E+00-1.0E+01)	*		*	*
Ru-103 (13)	7.1E-01 (5.5E-01-9.5E-01)	*		*	*
Ba-140 (13)	4.7E+00 (2.2E+00-8.6E+00)	*		*	*
Cs-134 (13)	6.4E-01 (4.8E-01-8.8E-01)	*		*	*
Ru-106 (13)	6.0E+00 (3.4E+00-8.1E+00)	*		*	*
Cs-137 (13)	8.1E-01 (4.6E-01-1.2E+00)	*		*	*
Zr-95 (13)	1.2E+00 (7.1E-01-1.8E+00)	*		*	*
Nb-95 (13)	7.2E-01 (4.7E-01-1.3E+00)	*		*	*
Co-58 (13)	7.4E-01 (3.8E-01-1.3E+00)	*		*	*
Mn-54 (13)	6.8E-01 (4.1E-01-1.1E+00)	*		*	*

TABLE 4.18 (Cont'd) 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

FISH, VARIOUS, EDIBLE RAW MASS Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ag-110m (13)	9.3E-01 (5.2E-01-1.3E+00)	*		*	*
Ac-228 (13)	2.4E+00 (8.7E-01-4.1E+00)	4.4E+00 (1/ 9) (4.4E+00-4.4E+00)	N06	4.4E+00 (1/ 3) (4.4E+00-4.4E+00)	*
Fe-59 (13)	1.9E+00 (1.1E+00-2.5E+00)	*		*	*
Zn-65 (13)	1.7E+00 (7.5E-01-2.6E+00)	*		*	*
Co-60 (13)	7.5E-01 (4.5E-01-1.2E+00)	*		*	*
K-40 (13)	7.0E+00 (3.3E+00-1.2E+01)	1.2E+02 (9/ 9) (9.0E+01-1.5E+02)	N06	1.3E+02 (3/ 3) (1.1E+02-1.5E+02)	1.1E+02 (4/ 4) (9.8E+01-1.1E+02)
La-140 (13)	1.5E+00 (5.5E-01-3.2E+00)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.19 96-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

LOBSTER (EDIBLE, COOKED MASS) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ce-144 (8)	5.8E+00 (3.5E+00-9.6E+00)	*		*	*
Ce-141 (8)	1.6E+00 (8.0E-01-3.0E+00)	*		*	*
Cr-51 (8)	9.1E+00 (4.0E+00-1.9E+01)	*		*	*
I-131 (8)	1.9E+00 (6.9E-01-4.4E+00)	*		*	*
Be-7 (8)	8.7E+00 (3.9E+00-1.5E+01)	*		*	*
Ru-103 (8)	9.0E-01 (5.2E-01-1.8E+00)	*		*	*
Ba-140 (8)	5.9E+00 (2.2E+00-1.7E+01)	*		*	*
Cs-134 (8)	9.4E-01 (3.8E-01-1.7E+00)	*		*	*
Ru-106 (8)	8.5E+00 (5.3E+00-1.2E+01)	*		*	*
Cs-137 (8)	1.1E+00 (6.1E-01-2.0E+00)	*		*	*
Zr-95 (8)	1.8E+00 (8.1E-01-2.7E+00)	*		*	*
Nb-95 (8)	9.6E-01 (4.6E-01-1.3E+00)	*		*	*
Co-58 (8)	9.8E-01 (4.2E-01-1.9E+00)	*		*	*
Mn-54 (8)	1.1E+00 (5.7E-01-1.6E+00)	*		*	*

TABLE 4.19 (Cont'd) 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

LOBSTER (EDIBLE, COOKED MASS) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ag-110m (8)	1.1E+00 (5.8E-01-1.6E+00)	*		*	*
Ac-228 (8)	3.4E+00 (2.4E+00-4.6E+00)	*		*	*
Fe-59 (8)	2.3E+00 (1.0E+00-3.6E+00)	*		*	*
Zn-65 (8)	2.4E+00 (9.6E-01-4.4E+00)	*		*	*
Co-60 (8)	1.1E+00 (5.7E-01-1.8E+00)	*		*	*
K-40 (8)	1.0E+01 (3.2E+00-1.8E+01)	9.1E+01 (8/ 8) (6.3E+01-1.2E+02)	N06	9.3E+01 (4/ 4) (8.1E+01-1.1E+02)	*
La-140 (8)	1.9E+00 (4.8E-01-6.5E+00)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.20 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

PERIWINKLES (EDIBLE MASS) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ce-144 (4)	6.6E+00 (4.3E+00-7.9E+00)	*		*	*
Ce-141 (4)	1.7E+00 (1.1E+00-2.1E+00)	*		*	*
Cr-51 (4)	9.5E+00 (6.7E+00-1.2E+01)	*		*	*
I-131 (4)	1.4E+00 (1.0E+00-1.8E+00)	*		*	*
Be-7 (4)	9.5E+00 (6.8E+00-1.3E+01)	*		*	*
Ru-103 (4)	1.1E+00 (9.2E-01-1.2E+00)	*		*	*
Ba-140 (4)	4.6E+00 (2.8E+00-6.9E+00)	*		*	*
Cs-134 (4)	1.0E+00 (7.7E-01-1.3E+00)	*		*	*
Ru-106 (4)	1.1E+01 (7.6E+00-1.3E+01)	*		*	*
Cs-137 (4)	9.1E-01 (7.2E-01-1.1E+00)	*		*	*
Zr-95 (4)	1.9E+00 (1.4E+00-2.9E+00)	*		*	*
Nb-95 (4)	1.1E+00 (8.3E-01-1.3E+00)	*		*	*
Co-58 (4)	1.1E+00 (9.1E-01-1.4E+00)	*		*	*
Mn-54 (4)	1.2E+00 (8.7E-01-1.3E+00)	*		*	*

TABLE 4.20 (Cont'd) 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

PERIWINKLES (EDIBLE MASS) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ag-110m (4)	1.7E+00 (1.1E+00-2.5E+00)	*		*	*
Ac-228 (4)	4.3E+00 (3.4E+00-5.3E+00)	*		*	*
Fe-59 (4)	2.9E+00 (1.7E+00-4.7E+00)	*		*	*
Zn-65 (4)	2.9E+00 (2.1E+00-3.7E+00)	*		*	*
Co-60 (4)	1.5E+00 (6.6E-01-2.3E+00)	*		*	*
K-40 (4)	1.2E+01 (6.4E+00-1.5E+01)	7.3E+01 (4/ 4) (5.8E+01-8.9E+01)	E03	7.3E+01 (4/ 4) (5.8E+01-8.9E+01)	*
La-140 (4)	1.7E+00 (8.7E-01-2.6E+00)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

86-03-19

TABLE 4.21
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

SCALLOPS (EDIBLE, RAW MASS) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ce-144 (8)	4.5E+00 (3.0E+00-6.7E+00)	*		*	*
Ce-141 (8)	1.2E+00 (7.1E-01-1.8E+00)	*		*	*
Cr-51 (8)	6.6E+00 (3.2E+00-9.8E+00)	*		*	*
I-131 (8)	1.6E+00 (7.5E-01-4.8E+00)	*		*	*
Be-7 (8)	6.2E+00 (3.7E+00-9.9E+00)	*		*	*
Ru-103 (8)	7.1E-01 (5.0E-01-1.1E+00)	*		*	*
Ba-140 (8)	4.5E+00 (2.3E+00-1.1E+01)	*		*	*
Cs-134 (8)	6.9E-01 (4.2E-01-1.0E+00)	*		*	*
Ru-106 (8)	7.3E+00 (4.6E+00-1.0E+01)	*		*	*
Cs-137 (8)	7.4E-01 (4.4E-01-1.1E+00)	*		*	*
Zr-95 (8)	1.3E+00 (6.3E-01-2.1E+00)	*		*	*
Nb-95 (8)	7.8E-01 (5.2E-01-1.1E+00)	*		*	*
Co-58 (8)	7.6E-01 (4.5E-01-9.4E-01)	*		*	*
Mn-54 (8)	6.2E-01 (4.0E-01-8.2E-01)	*		*	*

TABLE 4.21 (Cont'd) 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

SCALLOPS (EDIBLE, RAW MASS) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ag-110m (8)	1.0E+00 (6.6E-01-1.3E+00)	*		*	*
Ac-228 (8)	2.8E+00 (1.3E+00-3.9E+00)	*		*	*
Fe-59 (8)	1.8E+00 (1.2E+00-2.7E+00)	*		*	*
Zn-65 (8)	1.9E+00 (1.2E+00-3.0E+00)	*		*	*
Co-60 (8)	1.0E+00 (8.1E-01-1.4E+00)	*		*	*
K-40 (8)	8.2E+00 (2.9E+00-1.2E+01)	1.1E+02 (3/ 3) (9.5E+01-1.2E+02)	N06	1.1E+02 (1/ 1) (1.1E+02-1.1E+02)	1.1E+02 (5/ 5) (7.9E+01-1.5E+02)
La-140 (8)	1.7E+00 (5.3E-01-3.8E+00)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.22 86-03-19

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

SEA PLANT (WET MASS) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ce-144 (8)	5.0E+00 (2.7E+00-7.5E+00)	*		*	*
Ce-141 (8)	1.1E+00 (5.7E-01-1.6E+00)	*		*	*
Cr-51 (8)	6.2E+00 (3.4E+00-1.1E+01)	*		*	*
I-131 (8)	1.1E+00 (4.3E-01-1.9E+00)	*		*	*
Be-7 (8)	7.1E+00 (3.5E+00-1.2E+01)	1.5E+01 (2/ 8) (8.8E+00-2.2E+01)	E03	2.2E+01 (1/ 2) (2.2E+01-2.2E+01)	*
Ru-103 (8)	7.8E-01 (3.9E-01-1.3E+00)	*		*	*
Ba-140 (8)	3.4E+00 (1.2E+00-5.9E+00)	*		*	*
Cs-134 (8)	7.5E-01 (3.8E-01-1.3E+00)	*		*	*
Ru-106 (8)	6.7E+00 (3.4E+00-1.1E+01)	*		*	*
Cs-137 (8)	7.8E-01 (4.1E-01-1.4E+00)	*		*	*
Zr-95 (8)	1.3E+00 (6.0E-01-2.1E+00)	*		*	*
Nb-95 (8)	7.4E-01 (3.5E-01-1.4E+00)	*		*	*
Co-58 (8)	7.0E-01 (3.7E-01-1.4E+00)	*		*	*
Mn-54 (8)	6.9E-01 (4.2E-01-1.2E+00)	*		*	*

TABLE 4.22 (Cont'd) 86-03-19
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

SEA PLANT (WET MASS) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ag-110m (8)	1.0E+00 (4.8E-01-2.0E+00)	*		*	*
Ac-228 (8)	3.2E+00 (1.8E+00-4.6E+00)	*		*	*
Fe-59 (8)	2.1E+00 (1.2E+00-3.2E+00)	*		*	*
Zn-65 (8)	1.9E+00 (1.1E+00-3.4E+00)	*		*	*
Co-60 (8)	9.3E-01 (4.0E-01-1.5E+00)	*		*	*
K-40 (8)	7.7E+00 (2.9E+00-1.4E+01)	2.1E+02 (8/ 8) (2.0E+02-2.3E+02)	G04	2.2E+02 (2/ 2) (2.1E+02-2.3E+02)	*
La-140 (8)	1.0E+00 (2.5E-01-2.5E+00)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.23 86-03-19

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

VEGETATION (LICHEN) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ce-144 (13)	2.8E+01 (1.0E+01-7.1E+01)	*		*	*
Ce-141 (13)	6.8E+00 (2.6E+00-1.3E+01)	*		*	*
Cr-51 (13)	4.0E+01 (1.6E+01-9.9E+01)	*		*	*
I-131 (13)	6.4E+00 (2.0E+00-1.6E+01)	*		*	*
Be-7 (13)	3.9E+01 (1.5E+01-7.8E+01)	1.9E+02 (10/ 10) (4.6E+01-4.0E+02)	K01	2.0E+02 (7/ 7) (4.6E+01-4.0E+02)	2.1E+02 (3/ 3) (7.5E+01-3.4E+02)
Ru-103 (13)	4.5E+00 (1.4E+00-1.0E+01)	*		*	*
Ba-140 (13)	1.9E+01 (6.4E+00-4.1E+01)	*		*	*
Cs-134 (13)	4.2E+00 (1.7E+00-9.0E+00)	*		*	*
Ru-106 (13)	4.3E+01 (1.7E+01-8.8E+01)	*		*	*
Cs-137 (13)	5.5E+00 (2.0E+00-1.2E+01)	3.3E+01 (8/ 10) (2.0E+01-5.7E+01)	K01	3.9E+01 (5/ 7) (2.4E+01-5.7E+01)	3.8E+01 (3/ 3) (3.4E+01-4.3E+01)
Zr-95 (13)	7.1E+00 (3.1E+00-1.7E+01)	*		*	*
Nb-95 (13)	4.2E+00 (1.1E+00-1.0E+01)	*		*	*
Co-58 (13)	4.3E+00 (5.4E-01-1.3E+01)	*		*	*
Mn-54 (13)	3.9E+00 (1.6E+00-6.8E+00)	*		*	*

TABLE 4.23 (Cont'd)
Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

86-03-19

VEGETATION (LICHEN) Bq/kg

Analysis Type (Total Number)	Critical Level Mean (Range)	Indicator Stations Mean (F) (Range)	Highest Indicator Station Location	Highest Indicator Station Mean (F) (Range)	Reference Station Mean (F) (Range)
Ag-110m (13)	5.7E+00 (2.1E+00-1.4E+01)	*		*	*
Ac-228 (13)	1.5E+01 (7.8E+00-2.7E+01)	8.9E+01 (1/ 10) (8.9E+01-8.9E+01)	K01	8.9E+01 (1/ 7) (8.9E+01-8.9E+01)	*
Fe-59 (13)	9.0E+00 (2.4E+00-1.8E+01)	*		*	*
Zn-65 (13)	8.8E+00 (2.4E+00-2.3E+01)	*		*	*
Co-60 (13)	4.4E+00 (1.8E+00-8.7E+00)	*		*	*
K-40 (13)	4.6E+01 (7.3E+00-1.3E+02)	1.6E+02 (9/ 10) (9.7E+01-2.9E+02)	K01	1.6E+02 (6/ 7) (9.7E+01-2.9E+02)	1.2E+02 (2/ 3) (8.8E+01-1.4E+02)
La-140 (13)	6.1E+00 (2.0E+00-1.6E+01)	*		*	*

* : The activity is less than or equal to the Critical Level (99% Confidence Level).
F : Number of analyses greater than the Critical Level/Total number of analyses.

TABLE 4.24A

Point Lepreau Generating Station*
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

Strontium-90 in GEM samples. Wet Chemical Separation

WEEK	Sr-90 Bq/Filter	WEEK	Sr-90 Bq/Filter
	*		*
1	2.4E-02	27	<2.1E-02
2	2.3E-02	28	<2.4E-02
3	2.1E-02	29	<2.1E-02
4	<3.6E-02	30	<3.1E-02
5	<3.5E-02	31	3.0E-02
6	<3.5E-02	32	<3.1E-02
7	<3.4E-02	33	<2.0E-02
8	<3.7E-02	34	<3.0E-02
9	<3.9E-02	35	<2.0E-02
10	1.9E-02	36	<2.6E-02
11	<3.4E-02	37	<2.6E-02
12	<3.3E-02	38	<2.6E-02
13	<2.7E-02	39	<2.6E-02
14	<2.6E-02	40	<2.6E-02
15	<2.7E-02	41	<2.6E-02
16	<2.3E-02	42	<2.6E-02
17	<2.6E-02	43	<2.4E-02
18	<2.8E-02	44	<2.5E-02
19	<2.5E-02	45	<2.2E-02
20	<4.2E-02	46	2.2E-02
21	<2.1E-02	47	<3.8E-02
22	<2.4E-02	48	<2.4E-02
23	<2.1E-02	49	<2.4E-02
24	<2.1E-02	50	<2.4E-02
25	<2.1E-02	51	<2.4E-02
26	<2.1E-02	52	<2.4E-02

GEM Gaseous Effluent Monitoring samples collected weekly.

52 samples were collected with starting dates in 1985. The last collected sample overlaps into 1986.

* These values for Sr-90 include Sr-89. At the very low count rates on these samples it is not possible to determine accurately the usually minor Sr-89 component.

The precision of the analyses is about +- 2E-02 Bq/filter at 95% confidence.

TABLE 4.24B

Point Lepreau Generating Station
Environmental Radiation Monitoring
Summary of Analyses for the Period
85-01-01 to 85-12-31

Strontium-90 in LEM samples. Wet Chemical Separation

MONTH	Sr-90 (Bq/L)
JANUARY	7.2E-02 *
FEBRUARY	4.2E-02
MARCH	7.1E-02
APRIL	3.1E-02
MAY	2.2E-02
JUNE	<2.5E-02
JULY	<3.4E-02
AUGUST	<3.8E-02
SEPTEMBER	4.1E-02
OCTOBER	9.6E-02
NOVEMBER	3.4E-02
DECEMBER	6.1E-02

LEM Liquid Effluent Monitoring samples.

* These values also include a minor Sr-89 component. The count rates on the samples are too low to allow an accurate determination of the Sr-89.

± +- 2E-2 Bq/L at the 95% confidence level.

5.0 DISCUSSION OF ENVIRONMENTAL DATA

5.1 Airborne Particulate (filters) - Table 4.01

There were no detectable airborne particulate radionuclides that could be attributed to the operation of PLGS in 1985. As two of the air monitoring stations are well within the boundary fence, one of them only about 0.2 km from the stack, this would appear to indicate that particulate emissions in 1985 continue to be insignificant.
One of the 208 air particulate filters collected this year, was lost in high winds during a filter changeover at the start of the year.

Plots of the gross alpha/beta data at Welch Cove, about 1.5 km from the PLGS stack, are presented in Figures 5.1 and 5.2. The high points on the plots correspond to fallout in 1981, from the Chinese atmospheric bomb test in October of 1980. This spike indicates the high sensitivity of the analyses and, by comparison, the low activity levels of present emissions from Point Lepreau.

5.2 Airborne Radioiodine - Table 4.02

During this sampling period, all I-131 levels were below the Critical Level.

5.3 Airborne Tritium - Tables 4.03A, 4.03B and 4.03C

Tritium is the only radionuclide from PLGS currently seen in the Air Monitoring samples. Detection limits are close to the level of tritium occurring naturally in the atmosphere by cosmogenic activity. Levels above this, close to the station, generally indicate contributions from the operation of PLGS.
Table 4.03A is the summary table of 1985 tritium data; Table 4.03B gives details of 1985 tritium results by location and Table 4.03C is a summary of tritium data obtained to date since this program was started.

Since tritium is now detectable in Air Monitoring stations close to the PLGS stack, it has become possible to calculate the annual average empirical dilution factors for stack emissions and compare them with the graph value at 1km (2.2E-7 s/m3) used in the DEL licensing document (1). Results for 1984 and 1985 are presented in Table 5.10.

(1) "Derived Emission Limits for Radionuclides in Gaseous and Liquid Effluents." New Brunswick Electric Power Commission Report NBEPC-HP-76-1 1976.

TABLE 5.1

AVERAGE ATMOSPHERIC DISPERSION FACTOR FOR EACH AIR MONITORING LOCATION (1).

Locn.	E01 Maces Bay	F01 Welch Cove	G02 Light-house	H04 Info. Centre	I01 SRWMF	K02 Pump-house	N01 Dipper Hrbr.
km from stack	4.5	1.5	1.0	0.8	1.0	0.2	3.8
Year.	Dilution Factors: s/m3						
1984	8E-8	8E-8	2E-7	5E-7	7E-7*	5E-7	8E-8
1985	2E-8	4E-8	9E-8	3E-7	2E-7	3E-7	5E-8

(1) Excluding the Reference location A01R.

* This value includes a second source term i.e., contaminated containers temporarily stored in this facility in 1984, and should be ignored in the evaluation of dilution factors.

Using the graph of Weighted Mean Dilution Factor versus Distance from the Point of Continuous Emission, quoted in the DEL document, each of the dispersion factors can be corrected back to 1 km, and an arithmetic average obtained for the year. For 1984 and 1985, the average dispersion factors were 2.4E-07 and 1.3E-07 s/m3 respectively. The figures for the pumphouse location, too close to the point of release to be reliable, were ignored in the calculations.

5.4 Airborne Carbon-14 - Table 4.04.

Carbon-14 collection and analysis was started in 1983. Results for 1985 are summarised in table 4.04.

5.5 Environmental Gamma Radiation

5.5.1 TLD data - Tables 4.05A and 4.05B

Radiation levels during 1985, as measured by TLDs, are comparable with those measured over the last few years.
None of the environmental TLD measurements can be expected to show any detectable contribution of radioactivity from the normal operation of PLGS since

variation from year to year in background radiation (Table 4.05B) is high enough to swamp any contributions from PLGS, (the range over the last few years at any location covers about 300 microgray). Only one TLD was not recovered this year.

5.5.2 Gamma Survey Measurements Table 4.06

Environmental gamma survey measurements are made in the intertidal zone on beaches in the Point Lepreau area and at the Reference location, Q01R, 28 km to the ENE. Although TLDs are preferred in measuring such exposures since they span the entire year, they are not suitable for use in these locations.
Radiation levels in 1985 are consistent with those seen over the last few years. Long before any significantly elevated radiation levels are likely to be detected by these measurements, the gamma spectrometric analysis of sediments from these locations would already have indicated the presence of the responsible radionuclides.

5.6 Sediments - Tables 4.07A, 4.07B

Sediments collected from beaches and tidal mud flats contain only background levels of radiation, both from naturally occurring radionuclides and from the diminishing levels of Cs-137 fallout from the Chinese bomb test of 1980. One new sample location was added this year.
A summary of the Cs-137 levels in sediments over the last five years is given in table 4.07B.

5.7 Soil - Table 4.08

Soil was collected from around the SRWMF this year to assess the contained levels of Cs-137 in the surface vegetation (moss), through surface soil to sub-soil. The Cs-137 decreases from 110 Bq/kg in the moss through 40 to 7 Bq/kg in the soil and sub-soil. These activity levels are attributable to accumulation from fallout from the 1980 Chinese and earlier bomb tests. Cs-137 in a Bore Hole water sample appears to be correlated with the presence of soil in the ground water from surface run-off, after a dry autumn.

5.8 Well Water - Table 4.09

No gamma emitting radionuclides other than those occurring in nature, were detected in water samples during this sampling period.

5.9 Bore Hole Water (SRWMF) - Table 4.10

Waters from Bore Holes on the SRWMF site were analysed to assess levels of radionuclides. Tritium, as

tritiated water, was detected in 13 of 15 samples at an average level of about 160 Bq/L.
Cs-137 was detected at the level of 0.5 +-0.2 Bq/L, in only one sample, with associated K-40. The Cs-137 probably was carried into the Bore Hole in water containing suspended soil. Relatively high levels of Cs-137 are still present in soils across North America from pre-1981 bomb tests.

5.10 Parshall Flume (SRWMF)-Table 4.11

Rainwater, draining from the SRWMF in a specially constructed drainage channel (flume), is collected and analysed on a regular basis. In 1985, as in 1984, tritium was detected in the Parshall Flume water analyses. The activity levels of tritium are considerably lower than in 1984, and have decreased over the year since controls were placed on the movement and storage of containers from PLGS into this facility and since the main sample collection routine is now performed by external, rather than PLGS, personnel. No gamma emitting radionuclides, except for those that occur naturally, were detected in any of the analyses.

5.11 Lagoon Water - Table 4.12

Inactive-drainage liquid waste from PLGS is collected in drainage lagoons on the site. Tritium was detected in all but one of the samples analysed. Although this drainage system is normally inactive, radionuclides occur from time to time due to their presence in sumps and drains which are ultimately emptied to the lagoons. The lagoons are drained to the Condenser Cooling Water duct, hence the pathway to the environment is the same as for other liquid effluents.

5.12 Sea Water - Table 4.13

Naturally occurring K-40 was the only gamma emitting radionuclide found in sea water during the sampling period. Natural tritium levels in sea water are normally below the detection limits though detectable values just above the Critical Level have been recorded in the pre-operational program.
Calculations showed that the emitted activity of tritium in the liquid effluent pathway in 1985, would be sufficiently dispersed in sea water, that the tritium concentration would be at about one tenth of the critical level for its detection in sea water (about 20 Bq/L). Since tritium was not detected, this suggests that the magnitude of dispersion in sea water used in the DEL document is reasonably valid.

5.13 Milk - Table 4.14

Milk from a commercial dairy and milk samples from herds in the south of the province are analysed on a regular basis. There are no herds producing milk in the Point Lepreau area. The closest herds are in St. Andrews and Fredericton Junction, and they are sampled for analysis. Cs-137 from bomb tests in the 1950's through to as recent as 1980, is still detected at very low activity levels in several of the milk analyses. Natural radionuclides may also be concentrated into milk depending upon the age and breed of the cow as well as the condition of the pasture. No radionuclides from the operation of Point Lepreau have yet been detected.

5.14 Seafood - Tables 4.15 to 4.21

All of the seafoods analysed in the environmental program contain naturally occurring radionuclides e.g., K-40. No contributions from the operation of Point Lepreau have been detected even though one of the samples (consisting of several crabs) was collected at the cooling water outflow from PLGS.

5.15 Sea Plants - Table 4.22

Seaweeds other than Dulse are also analysed. Other species of sea weed, (for example, Ascophylum) are readily available from the rocks on the Point Lepreau peninsula close to the outfall and are collected and analysed when dulse is not available.

5.16 Vegetation (Lichen) - Table 4.23

Lichen concentrate a wide range of radionuclides and are sensitive indicators of radionuclides in the environment. Present levels of, for example, Cs-137 (20 to 100 Bq/kg), are mostly a result of fallout from the 1980 Chinese bomb test as well as previous atmospheric tests. No detectable emissions of Cs-137 have taken place from PLGS and the current levels seen in lichen are consistent with those seen prior to PLGS startup. The long halflife of Cs-137 and its relative persistence in lichen will ensure its presence for some time into the future. Although there is no consistent means of correlating atmospheric concentration and uptake into the lichen to obtain quantitative data, this plant nevertheless is a sensitive indicator to flag otherwise undetectable fluctuations of radionuclides in the environment.

5.17 Sr-90 Analyses - Tables 4.24A and 4.24B.

Strontium-90 analyses were made on both gaseous effluent (GEM) and liquid effluent (LEM) samples covering the entire year. Radiostrontium was detected above the Critical Level in some of these samples. However, because of the relatively low level of activity in these source emissions and high atmospheric and sea water dispersion factors, detection in environmental samples was not attempted. Discrimination between Sr-90 and Sr-89 (if present), requires a moderate count rate, which is generally not attained on any of these samples. The relatively short half life of Sr-89 (50 d), coupled with the time interval between the start of sample collection and the time of the analysis for radiostrontium (up to 90 d), also limits the usefulness of its determination in relation to Sr-90.

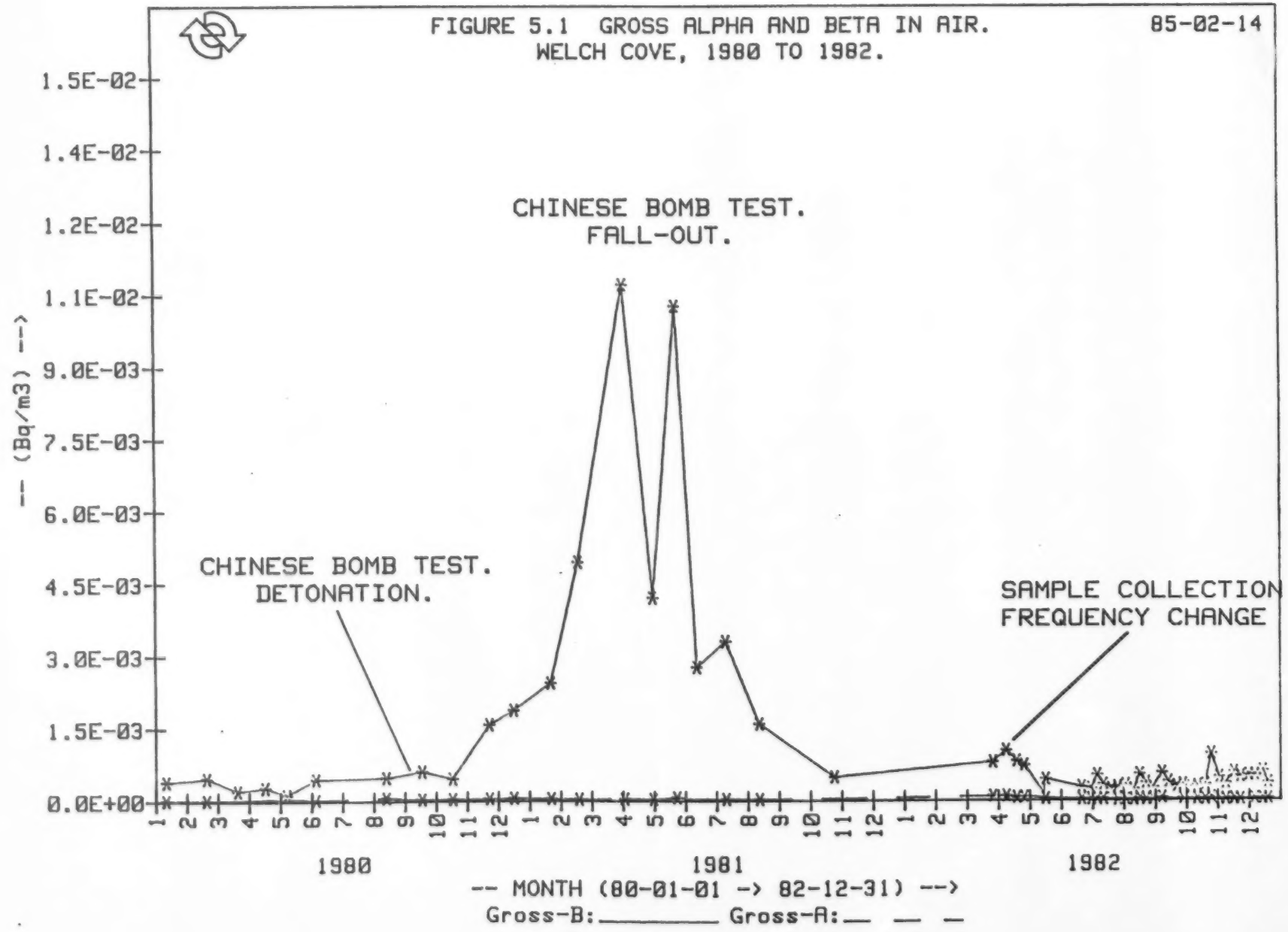


FIGURE 5.1 GROSS ALPHA AND BETA IN AIR.
WELCH COVE, 1980 TO 1982.
85-02-14
1.5E-02
1.4E-02
1.2E-02
1.1E-02
9.0E-03
7.5E-03
6.0E-03
4.5E-03
3.0E-03
1.5E-03
0.0E+00
-- (Bq/m3) -->
CHINESE BOMB TEST.
FALL-OUT.
CHINESE BOMB TEST.
DETONATION.
SAMPLE COLLECTION
FREQUENCY CHANGE
1980
1981
1982
-- MONTH (80-01-01 -> 82-12-31) -->
Gross-B:_____ Gross-A:__ __ __

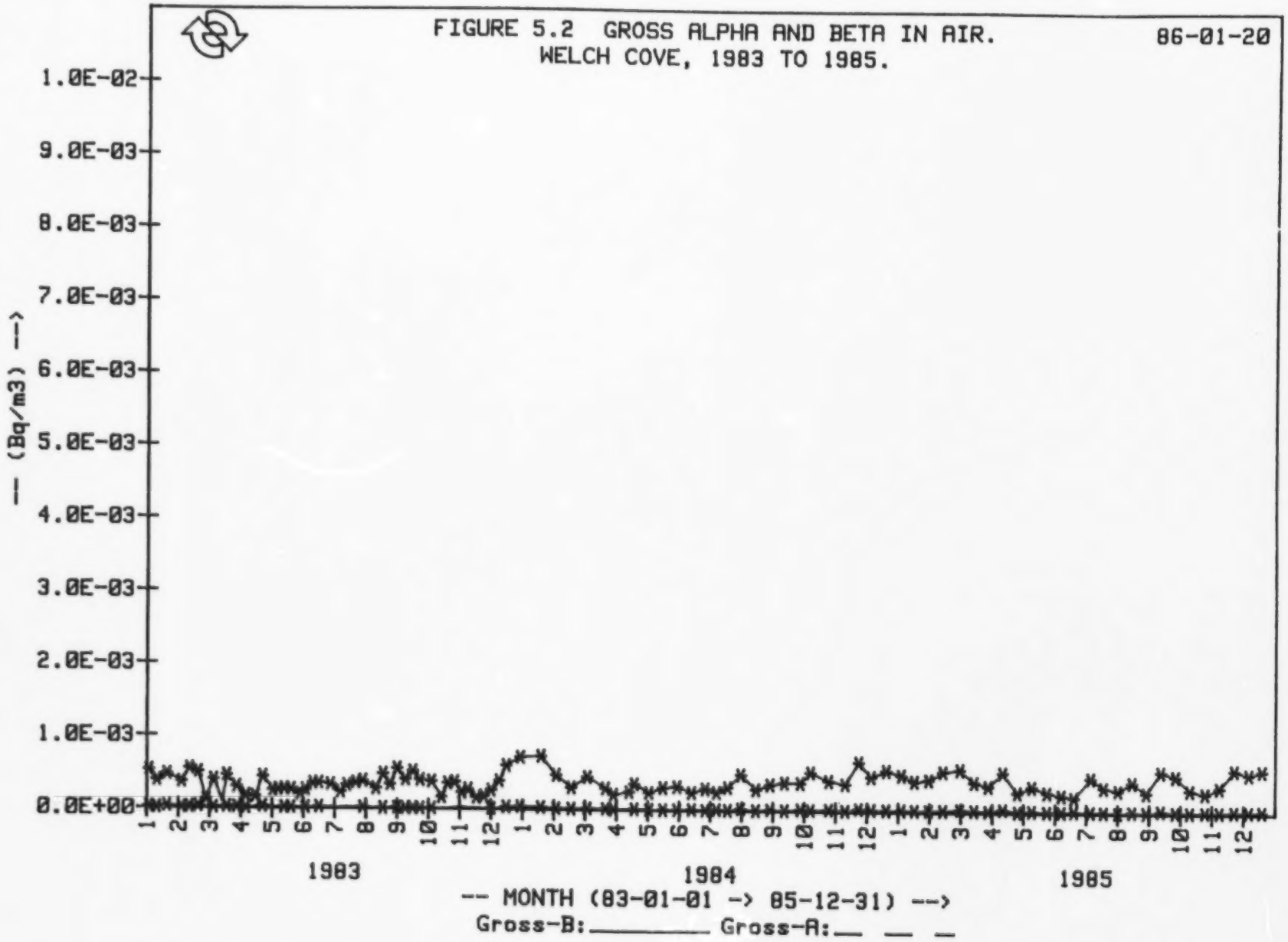


FIGURE 5.2 GROSS ALPHA AND BETA IN AIR.
WELCH COVE, 1983 TO 1985.
86-01-20
1.0E-02
9.0E-03
8.0E-03
7.0E-03
6.0E-03
5.0E-03
4.0E-03
3.0E-03
2.0E-03
1.0E-03
0.0E+00
— (Bq/m3) —>
1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
1983
1984
1985
-- MONTH (83-01-01 -> 85-12-31) -->
Gross-B:_____ Gross-A:__ __ _

6.0 SOURCE EMISSION DATA FROM POINT LEPREAU.

Tables 6.1 and 6.2, summarize the emissions from Point Lepreau since startup in 1982. Figure 6.1, shows the power level achieved since that time, on a monthly basis.

The information for the Liquid Effluent and Airborne pathways from PLGS is used not only to control the frequency of sample collection in the environmental monitoring program but also to indicate which pathways and sample types may need to be more closely examined.

Correlation of the emitted tritium activity with that seen in airborne water vapour, indicates the validity of the dispersion factors used in the Derived Emission Limits calculations. To the present time, tritium is the only radionuclide detected off-site, which is attributable to the operation of PLGS.

The correlation between observed and expected tritium levels in the air monitoring stations indicates that in the airborne pathway, the assumed Dilution Factor of 2.2E-07 s/m3 is sufficiently accurate.

Analyses in the sea water pathway have so far not detected any radionuclides from Point Lepreau in any of the samples, not even in those crabs, fish or lobster collected either in or close to the outfall area.

Calculation of the expected tritium activity levels in sea water, based upon emission data for 1985, suggest that the present tritium content of sea water due to emissions from PLGS, is about an order of magnitude below the Critical Level for its detection by present methods of analysis.

No other radionuclides have been emitted in sufficient quantity since Point Lepreau became operational to be seen in any environmental sample.

In assessing a long term average dilution factor for radionuclide dispersion in the environment, the use of empirical data spanning several years is desirable since short term weather patterns, less than a few years, may be neither typical nor consistent.

Table 6.1

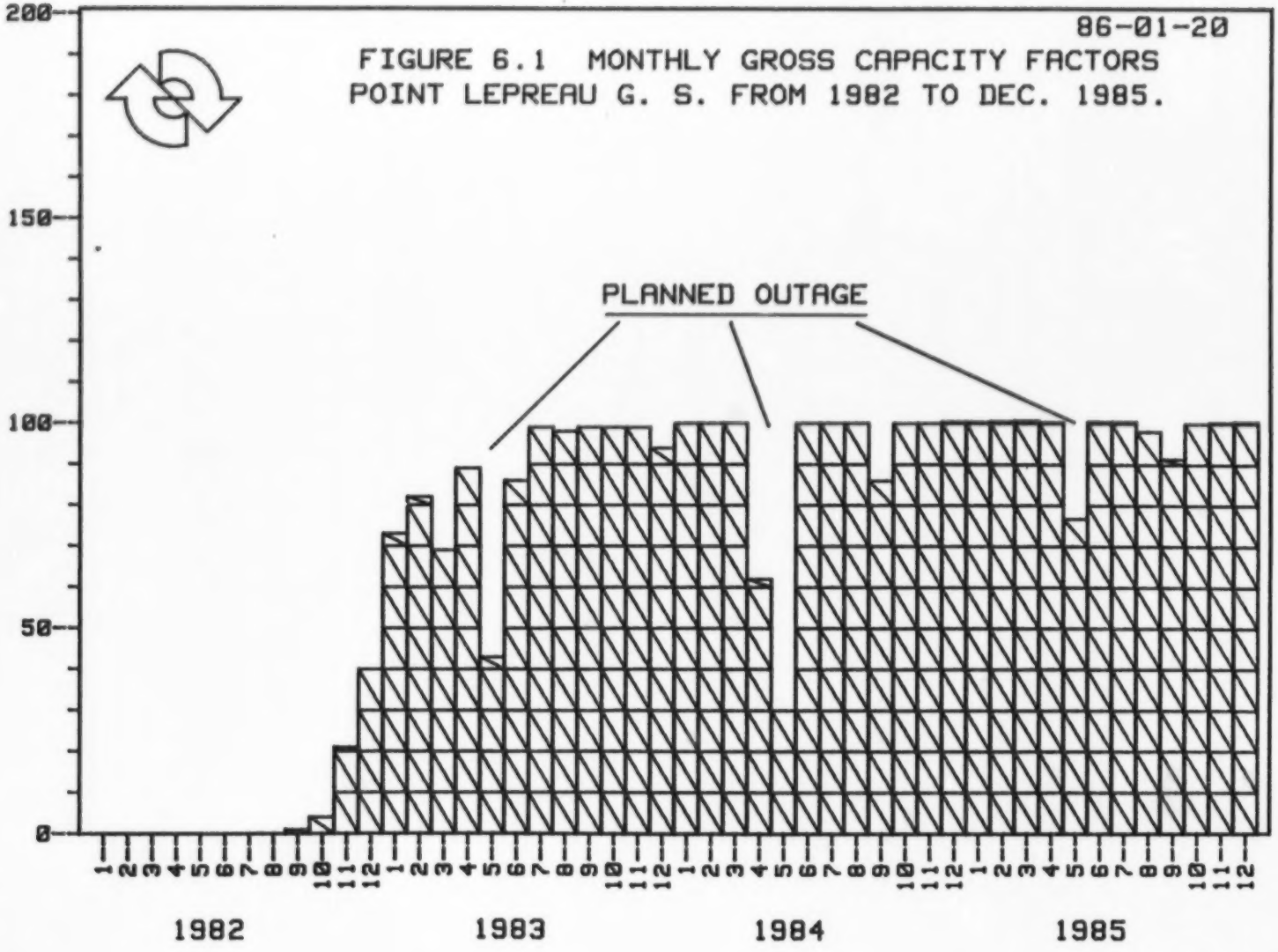
Liquid Effluent Pathway Emission Data (%DEL)

Radionuc.	MONTHLY DEL (Bq)	1983	1984	1985
H-3	4E+18	1.9E-05	1.5E-04	5.1E-05
Cr-51	2E+15	3.2E-06	4.7E-05	1.2E-07
Mn-54	2E+13	1.2E-07	9.2E-05	6.0E-07
Co-58	7E+13	.....	1.0E-06	.....
Fe-59	1E+13	1.6E-05	7.2E-05	1.6E-06
Co-60	3E+13	2.3E-06	8.1E-05	4.1E-06
Zn-65	9E+12	.....	4.1E-07	1.8E-07
Sr-90	2E+14	.....	2.2E-08	3.8E-10
Zr-95	6E+13	7.4E-06	3.9E-05	1.7E-05
Nb-95	6E+13	1.2E-05	7.1E-05	2.9E-05
Ru-103	1E+14	4.6E-07	5.7E-09	4.2E-07
Ru-106	2E+13	.....	1.3E-06	.....
Ag-110m	1E+13	1.8E-07	7.3E-08	4.0E-07
I-131	1E+13	1.4E-03	3.4E-05	8.2E-04
Cs-134	4E+13	1.8E-07	2.3E-06	6.7E-08
Cs-137	7E+13	.....	7.6E-06	7.9E-07
La-140	2E+14	3.6E-08	1.1E-08	.....
Ba-140	2E+14	.....	.....	.....
Ce-141	2E+14	2.5E-08	1.1E-08	.....
Ce-144	2E+13	3.3E-06	8.1E-07	5.4E-07

Table 6.2

Gaseous Effluent Pathway Emission Data (%DEL)

Radionuc.	WEEKLY DEL (Bq)	1983	1984	1985
H-3	3E+16	1.6E-03	4.3E-03	6.8E-03
Co-60	9E+12	.....	.....	.....
Ru-106	4E+12	.....	.....	.....
I-131	5E+10	3.6E-04	.....	1.5E-04
Cs-134	2E+12	.....	.....	.....
Cs-137	5E+12	.....	.....	.....
Noble Gas	7E+15	1.2E-03	.....	2.5E-04


86-01-20
FIGURE 6.1 MONTHLY GROSS CAPACITY FACTORS
POINT LEPREAU G. S. FROM 1982 TO DEC. 1985.
PLANNED OUTAGE
200
150
100
50
0
1982
1983
1984
1985
MONTHLY INTERVAL

7.0 QUALITY CONTROL AND QUALITY ASSURANCE

7.1 Introduction

Internal Quality Control checks and performance of calibrations traceable to U.S. or Canadian National Standards are routine for all analytical techniques in the Health Physics Environmental Laboratory. In addition, Quality Assurance programs regularly test the accuracy of the laboratory analytical procedures by submitting a variety of samples for blind analysis.

7.2 Quality Control

The daily Quality Control (QC) evaluations in the laboratory cover the following instruments:

1. Intrinsic Ge Gamma Spectrometer
2. Beckman LS-100C Liquid Scintillation Counter
3. Tennelec LB-5100 Gross Alpha/Beta Detector
4. Panasonic UD-710A TLD Reader

In the QC program, the operating parameters of each of the major instruments are evaluated at the start of each working day. This ensures that they are consistent from day to day and remain free from significant drift or random variation that could influence the analyses. A compilation of the statistical fluctuations is maintained day by day to show the upper and lower limits usually seen over the period of the year and from one year to the next. From these data, upper and lower flag limits are set in the QC programs. If any of the equipment exceeds any of these flag limits, then it is usually not used in any of the laboratory operations until the problem has been corrected. If, in the judgement of the laboratory supervisor, the problem will not give rise to errors in deriving data, usually because of the presence of internal standards, the equipment may still be used.

7.2.1 Intrinsic Ge Gamma Spectrometer

A daily check of seven system parameters is performed for the germanium gamma spectrometry system. The results are processed by a computer program which generates QC plots and performs statistical tests to detect out-of-range values. The program processes the results from the analysis of a Eu-152 point source which is analysed at the beginning of each working day. The parameters checked are:

1. Low energy centroid location (122 keV)
2. Low energy efficiency (122 keV)
3. Low energy resolution (122 keV)
4. High energy centroid location (1408 keV)
5. High energy efficiency (1408 keV)
6. High energy resolution (1408 keV)
7. Liquid nitrogen consumption (mass/h)

A 50000+ s background count is made weekly to ensure the absence of contamination in the sample chamber. The total counts in eight separate regions of the background spectrum are evaluated by the QC program and out-of-range values are flagged. Because of the precautions adopted in handling all samples analysed in the laboratory, no contamination has been found to date.

Calibration

Complete efficiency calibrations on the gamma spectrometry systems are performed on an annual basis -usually at the beginning of each year- for each of the counting geometries. This is accomplished by use of an Amersham mixed nuclide standard traceable to the US National Bureau of Standards.

7.2.2 Beckman Liquid Scintillation Counter

A range of sealed tritium, carbon-14 and background standards traceable to US National Standards is analysed daily.

7.2.3 Tennelec LB-5100 Gross Alpha/Beta Detector

Planchet standards of Am-241 and Sr-Y-90 are analysed daily. Alpha and Beta discrimination allows the simultaneous analysis of alpha and beta emissions on all samples analysed. Planchet and filter backgrounds are included in the QC checks.

7.2.4 Panasonic UD-710A TLD Reader

A random set of 16 TLDs is exposed daily on a depleted uranium slab for about 30 minutes. Readout of these TLDs monitors the Reader functions.

7.3 External Intercomparison Programs

In addition to these in-house QC checks, the Health Physics Environmental Laboratory participates in routine intercomparisons with other laboratories when appropriate programs are available. This allows independent verification of analytical performance. Table 7.01 lists the intercomparison programs in which NBEPC takes part.

TABLE 7.01

QUALITY ASSURANCE PROGRAMS INVOLVING OTHER AGENCIES

Sample Type	Analysis	Frequency #	Agency
Air Filters	Gross Alpha Gross beta Cs-137 Sr-90	6 months	US EPA*
Environmental Gamma rad.	TLD	Approx. every 2 years	US DOE*
Milk	Gamma	4 Months	US EPA
Fresh Water	Gross Alpha Gross beta Tritium Gamma Blind test Sr-89,90	2 months 2 months 2 months 2 months 6 months 4 months	US EPA
Food Slurry	Gamma	6 months	US EPA

* EPA US Environmental Protection Agency.
DOE US Department of Energy.

\# The actual frequency may vary from that indicated depending upon the ability of the QA agent to supply the sample.

7.4 Results of Intercomparison programs

Details of performance in the laboratory intercomparisons are given in Tables 7.02 to 7.24 following. The order of the QA data is as follows:

Table 7.02	Comparison of EPA - All users and NBEPC Performance.
Table 7.03	Laboratory Performance Evaluation.
Table 7.04	Laboratory Performance Evaluation.
Table 7.05	EPA Food Slurry.
Table 7.06	EPA Food Slurry.
Table 7.07	EPA Sr-89,90 in Water.
Table 7.08	EPA Sr-89,90 in Water.
Table 7.09	EPA Sr-89,90 in Water.
Table 7.10	EPA Gamma in Water.
Table 7.11	EPA Gamma in Water.
Table 7.12	EPA Gamma in Water.
Table 7.13	EPA Gamma in Milk.
Table 7.14	EPA Gamma in Milk.
Table 7.15	EPA Gamma in Milk.
Table 7.16	EPA Gross Alpha in Air Filter.
Table 7.17	EPA Iodine in Water.
Table 7.18	EPA Sr-90 in Air Filter.
Table 7.19	EPA Gross Beta in Air Filter.
Table 7.20	EPA Cs-137 in Air Filter.
Table 7.21	EPA Tritium in Water.
Table 7.22	EPA Tritium in Urine.
Table 7.23	EPA Gross Alpha in Water.
Table 7.24	EPA Gross Beta in Water.

TLDs for the Eighth International Environmental Dosimeter Intercomparison Project were submitted to the testing agent in October 1985. Results of the program will be available for inclusion in the 1986 report.

Each table (except table 7.02), contains the known results given by the QA agent, the average obtained by all other participants, and the results obtained by NBEPC. The quoted uncertainties are at the 95% confidence level unless indicated otherwise.

7.5 Discussion of QA results

The QA results for 1985 show that the laboratory equipment operated satisfactorily and that the techniques were able to provide accurate information on the test samples.

The method for the analysis of Sr-89 and Sr-90 has been refined over the last year and is now capable of yielding more accurate data than previously. Severe limitations to accuracy were inherent in the use of immediate, short term counts for the determinations as described in most commonly used methods of analysis. The method incorporated errors due to poor statistics, interfering radon daughters and rapid yttrium-90 ingrowth. The modifications involve the use of several sets of 100 minute analyses for each determination, with no limitation caused by ingrowing yttrium-90. The initial short term counts are not required other than as qualitative indicators, and thus, radon daughter interferences are eliminated.

TABLE 7.02

COMPARISON OF EPA, ALL PARTICIPANTS, AND NBEPC.

Analysis	Table No.	Ratio of Results NBEPC/EPA	+- 2 sigma range All Participants
Cs-137	7.03	0.92	0.67 - 1.50
	7.04	1.11	NA
	7.05	1.10	0.79 - 1.34
	7.06	1.00	0.86 - 1.28
	7.10	1.16	0.76 - 1.24
	7.11	1.10	0.75 - 1.35
	7.12	1.00	0.80 - 1.20
	7.14	0.82	0.82 - 1.36
	7.15	1.00	NA
	7.20	1.17	0.67 - 1.67
	7.20	0.88	0.62 - 1.62
H-3	7.21	1.03	0.84 - 1.23
	7.21	1.02	0.84 - 1.14
	7.21	0.91	0.74 - 1.25
	7.21	0.98	0.83 - 1.14
	7.21	1.00	0.80 - 1.21
	7.22	0.82	0.64 - 1.31
Sr-90	7.03	0.73	0.67 - 1.20
	7.04	0.89	NA
	7.07	0.87	0.73 - 1.13
	7.08	0.80	0.73 - 1.27
	7.09	1.00	0.57 - 1.43
	7.18	1.00	0.73 - 1.27
	7.18	1.00	0.78 - 1.22
Sr-89	7.03	1.20	0.20 - 1.80
	7.04	0.96	NA
	7.08	0.95	0.48 - 1.38
	7.09	1.00	0.45 - 1.45
Gross Beta	7.03	0.94	0.71 - 1.24
	7.04	0.94	NA
	7.19	1.00	0.75 - 1.36
	7.19	1.07	0.77 - 1.36
	7.24	1.07	0.60 - 1.40
	7.24	1.18	0.55 - 1.64
	7.24	1.13	0.38 - 1.88
	7.24	1.00	0.50 - 1.50
	7.24	1.08	0.62 - 1.54

NA Final data from the QA agent not yet available.

TABLE 7.03
New Brunswick Electric Power Commission
Health Physics Department
Environmental Laboratory
Quality Assurance Program

Intercomparison with: EPA — Reporting units: pCi/L +- 2 sigma
Program: EPA LAB PERFORMANCE EVAL. — Collection date: 85-04-19

Analysis	EPA	* All participants	NBEPC	NBEPC/EPA
GROSS ALPHA	32 +- 7	31 +- 20	34 +- 10	1.06
GROSS BETA	72 +- 7	70 +- 19	68 +- 3	0.94
Sr-89	10 +- 7	10 +- 8	12 +- 1	1.20
Sr-90	15 +- 2	14 +- 4	11 +- 1	0.73
Co-60	15 +- 7	16 +- 5	15 +- 6	1.00
Cs-134	15 +- 7	15 +- 6	13 +- 2	0.87
Cs-137	12 +- 7	13 +- 5	11 +- 3	0.92

TABLE 7.04

Intercomparison with: EPA — Reporting units: pCi/L +- 2 sigma
Program: EPA LAB PERFORMANCE EVAL. — Collection date: 85-10-21

Analysis	EPA	* All participants	NBEPC	NBEPC/EPA
GROSS ALPHA	52 +- 18	NA	48 +- 1	0.92
GROSS BETA	86 +- 7	NA	81 +- 5	0.94
Sr-89	27 +- 7	NA	26 +- 1	0.96
Sr-90	9 +- 2	NA	8 +- 0	0.89
Co-60	18 +- 7	NA	16 +- 10	0.89
Cs-134	18 +- 7	NA	13 +- 3	0.72
Cs-137	18 +- 7	NA	20 +- 7	1.11

NA: Results Not Available

* Excluding those results significantly different from the population mean.

TABLE 7.05
New Brunswick Electric Power Commission
Health Physics Department
Environmental Laboratory
Quality Assurance Program

Intercomparison with: EPA
Program: EPA FOOD SLURRY

Reporting units: pCi/kg +- 2 sigma
Collection date: 85-01-25

Analysis	EPA	* All participants	NBEPC	NBEPC/EPA
I-131	35 +- 8	36 +- 11	32 +- 1	0.91
Cs-137	29 +- 7	31 +- 8	32 +- 5	1.10
K(mg/kg)	1382 +- 170	1379 +- 190	1410 +- 50	1.02

TABLE 7.06

Intercomparison with: EPA
Program: EPA FOOD SLURRY

Reporting units: pCi/kg +- 2 sigma
Collection date: 85-07-26

Analysis	EPA	* All participants	NBEPC	NBEPC/EPA
I-131	35 +- 8	37 +- 10	29 +- 10	0.83
Cs-137	29 +- 7	31 +- 6	29 +- 1	1.00
K(mg/kg)	1514 +- 107	1500 +- 240	1430 +- 20	0.94

* Excluding those results significantly different from the population mean.

TABLE 7.07
New Brunswick Electric Power Commission
Health Physics Department
Environmental Laboratory
Quality Assurance Program

Intercomparison with: EPA — Reporting units: pCi/L +- 2 sigma
Program: EPA Sr-89,90 IN WATER — Collection date: 85-01-04

Analysis	EPA	* All participants	NBEPC	NBEPC/EPA
Sr-89	3 +- 7	6 +- 4	<2	
Sr-90	30 +- 2	28 +- 6	26 +- 3	0.87

TABLE 7.08

Intercomparison with: EPA — Reporting units: pCi/L +- 2 sigma
Program: EPA Sr-89,90 IN WATER — Collection date: 85-05-10

Analysis	EPA	* All participants	NBEPC	NBEPC/EPA
Sr-89	39 +- 7	36 +- 17	37 +- 2	0.95
Sr-90	15 +- 2	14 +- 5	12 +- 1	0.80

TABLE 7.09

Intercomparison with: EPA — Reporting units: pCi/L +- 2 sigma
Program: EPA Sr-89,90 IN WATER — Collection date: 85-09-06

Analysis	EPA	* All participants	NBEPC	NBEPC/EPA
Sr-89	20 +- 7	19 +- 10	20 +- 1	1.00
Sr-90	7 +- 2	7 +- 3	7 +- 0	1.00

* Excluding those results significantly different from the population mean.

TABLE 7.10
New Brunswick Electric Power Commission
Health Physics Department
Environmental Laboratory
Quality Assurance Program

Intercomparison with: EPA
Program: EPA GAMMA IN WATER
Reporting units: pCi/L +- 2 sigma
Collection date: 85-02-08

Analysis	EPA	* All participants	NBEPC	NBEPC/EPA
Cr-51	48 +- 7	47 +- 18	<100	
Co-60	20 +- 7	19 +- 6	20 +- 8	1.00
Zn-65	55 +- 7	56 +- 12	57 +- 18	1.04
Ru-106	25 +- 7	25 +- 14	<70	
Cs-134	35 +- 7	33 +- 8	36 +- 5	1.03
Cs-137	25 +- 7	25 +- 6	29 +- 7	1.16

TABLE 7.11

Intercomparison with: EPA
Program: EPA GAMMA IN WATER
Reporting units: pCi/L +- 2 sigma
Collection date: 85-06-07

Analysis	EPA	* All participants	NBEPC	NBEPC/EPA
Cr-51	44 +- 7	48 +- 21	<100	
Co-60	14 +- 7	15 +- 5	12 +- 3	0.86
Zn-65	47 +- 7	49 +- 12	49 +- 12	1.04
Ru-106	62 +- 7	58 +- 24	<80	
Cs-134	35 +- 7	33 +- 8	31 +- 5	0.89
Cs-137	20 +- 7	21 +- 6	22 +- 8	1.10

* Excluding those results significantly different from the population mean.

TABLE 7.12
New Brunswick Electric Power Commission
Health Physics Department
Environmental Laboratory
Quality Assurance Program

Intercomparison with: EPA
Program: EPA GAMMA IN WATER

Reporting units: pCi/L +- 2 sigma
Collection date: 85-10-04

Analysis	EPA	* All participants	NBEPC	NBEPC/EPA
Cr-51	21 +- 7	24 +- 22	<50	
Co-60	20 +- 7	20 +- 4	21 +- 8	1.05
Zn-65	19 +- 7	20 +- 7	23 +- 5	1.21
Ru-106	20 +- 7	23 +- 15	<50	
Cs-134	20 +- 7	19 +- 5	18 +- 4	0.90
Cs-137	20 +- 7	20 +- 4	20 +- 11	1.00

* Excluding those results significantly different from the population mean.

TABLE 7.13
New Brunswick Electric Power Commission
Health Physics Department
Environmental Laboratory
Quality Assurance Program

Intercomparison with: EPA
Program: EPA GAMMA IN MILK
Reporting units: pCi/L +- 2 sigma
Collection date: 85-03-01

Analysis	EPA	* All participants	NBEPC	NBEPC/EPA
I-131	9 +- 1	8 +- 4	9 +- 1	1.00

TABLE 7.14

Intercomparison with: EPA
Program: EPA GAMMA IN MILK
Reporting units: pCi/L +- 2 sigma
Collection date: 85-06-28

Analysis	EPA	* All participants	NBEPC	NBEPC/EPA
I-131	11 +- 8	12 +- 5	11 +- 6	1.00
Cs-137	11 +- 7	12 +- 3	9 +- 0	0.82
K(mg/L)	1525 +- 107	1524 +- 234	1500 +- 30	0.98

TABLE 7.15

Intercomparison with: EPA
Program: EPA GAMMA IN MILK
Reporting units: pCi/L +- 2 sigma
Collection date: 85-10-25

Analysis	EPA	* All participants	NBEPC	NBEPC/EPA
I-131	42 +- 8	NA	37 +- 8	0.88
Cs-137	56 +- 7	NA	56 +- 1	1.00
K(mg/L)	1540 +- 109	NA	1560 +- 30	1.01

NA: Results Not Available

* Excluding those results significantly different from the population mean.

TABLE 7.16
New Brunswick Electric Power Commission
Health Physics Department
Environmental Laboratory
Quality Assurance Program

Intercomparison with: EPA Reporting units: pCi +- 2 sigma
Program: EPA GROSS ALPHA IN AIR FILTER

Collection date	EPA	* All participants	NBEPC	NBEPC/EPA
85-03-29	10 +- 7	11 +- 5	10 +- 1	1.00
85-08-30	13 +- 7	13 +- 5	13 +- 2	1.00

* Excluding those results significantly different from the population mean.

TABLE 7.17
New Brunswick Electric Power Commission
Health Physics Department
Environmental Laboratory
Quality Assurance Program

Intercomparison with: EPA
Program: EPA IODINE IN WATER

Reporting units: pCi/L +- 2 sigma

Collection date	EPA	* All participants	NBEPC	NBEPC/EPA
85-04-05	8 +- 1	7 +- 3	7 +- 2	0.93
85-08-09	33 +- 8	32 +- 8	28 +- 17	0.85
85-12-06	45 +- 8	NA	42 +- 15	0.93

NA: Results Not Available

* Excluding those results significantly different from the population mean.

TABLE 7.18
New Brunswick Electric Power Commission
Health Physics Department
Environmental Laboratory
Quality Assurance Program

Intercomparison with: EPA Reporting units: pCi +- 2 sigma
Program: EPA Sr-90 IN AIR FILTER

Collection date	EPA	* All participants		NBEPC		NBEPC/EPA
85-03-29	15 +- 2	15 +-	4	15 +-	2	1.00
85-08-30	18 +- 2	18 +-	4	18 +-	1	1.00

TABLE 7.19

Intercomparison with: EPA Reporting units: pCi +- 2 sigma
Program: EPA GROSS BETA IN AIR FILTER

Collection date	EPA	* All participants		NBEPC		NBEPC/EPA
85-03-29	36 +- 7	38 +-	11	36 +-	3	1.00
85-08-30	44 +- 7	47 +-	13	47 +-	5	1.07

TABLE 7.20

Intercomparison with: EPA Reporting units: pCi +- 2 sigma
Program: EPA Cs-137 IN AIR FILTER

Collection date	EPA	* All participants		NBEPC		NBEPC/EPA
85-03-29	6 +- 7	7 +-	3	7 +-	1	1.17
85-08-30	8 +- 7	9 +-	4	7 +-	1	0.88

* Excluding those results significantly different from the population mean.

TABLE 7.21
New Brunswick Electric Power Commission
Health Physics Department
Environmental Laboratory
Quality Assurance Program

Intercomparison with: EPA
Program: EPA TRITIUM IN WATER
Reporting units: pCi/L +- 2 sigma

Collection date	EPA	* All participants	NBEPC	NBEPC/EPA
85-02-15	3796 +- 518	3916 +- 744	3920 +- 750	1.03
85-04-12	3559 +- 515	3534 +- 536	3620 +- 220	1.02
85-06-14	2416 +- 496	2399 +- 623	2200 +- 350	0.91
85-08-16	4480 +- 634	4422 +- 681	4410 +- 230	0.98
85-10-11	1974 +- 488	1984 +- 400	1980 +- 200	1.00

TABLE 7.22

Intercomparison with: EPA
Program: EPA TRITIUM IN URINE
Reporting units: pCi/L +- 2 sigma

Collection date	EPA	* All participants	NBEPC	NBEPC/EPA
85-04-26	3056 +- 508	2981 +- 1022	2500 +- 800	0.82
85-11-08	3586 +- 516	3636 +- 668	<2500	

* Excluding those results significantly different from the population mean.

TABLE 7.23
New Brunswick Electric Power Commission
Health Physics Department
Environmental Laboratory
Quality Assurance Program

Intercomparison with: EPA
Program: EPA GROSS ALPHA IN WATER
Reporting units: pCi/L +- 2 sigma

Collection date	EPA	* All participants	NBEPC	NBEPC/EPA
85-03-22	6 +- 7	6 +- 4	7 +- 1	1.17
85-05-24	12 +- 7	10 +- 6	15 +- 2	1.25
85-07-19	11 +- 7	9 +- 6	11 +- 1	1.00
85-09-20	8 +- 7	8 +- 4	9 +- 3	1.13
85-11-22	10 +- 7	10 +- 6	14 +- 2	1.40

TABLE 7.24

Intercomparison with: EPA
Program: EPA GROSS BETA IN WATER
Reporting units: pCi/L +- 2 sigma

Collection date	EPA	* All participants	NBEPC	NBEPC/EPA
85-03-22	15 +- 7	15 +- 6	16 +- 2	1.07
85-05-24	11 +- 7	12 +- 6	13 +- 1	1.18
85-07-19	8 +- 7	9 +- 6	9 +- 0	1.13
85-09-20	8 +- 7	8 +- 4	8 +- 1	1.00
85-11-22	13 +- 7	14 +- 6	14 +- 2	1.08

* Excluding those results significantly different from the population mean.